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Volume 2

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Damage Tolerant Design Handbook

A Compilation of Fracture and Crack-Growth Data
for High Strength Alloys

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Prepared by

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This edition entirely revamps the 1975 edition. This edition is arranged by alloy rather than by property as in the previous addition. The data are presented in eight chapters and four volumes. Plane-strain fracture toughness (K_{IC}), critical plane stress fracture toughness, apparent fracture toughness, R-curve, fatigue crack growth rates, sustained-load crack growth rate and threshold stress intensity (K_{ISCC}) data are presented for stainless steels, titanium alloys, nickel-base alloys, alloy steels, 2000-, 6000- and 7000-series aluminum alloys.

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TABLE 1.4

ABBREVIATIONS FOR MATERIAL SYSTEMS

Abbreviation	Materials
ALUM	Aluminum Alloys
TITAN.	Titanium Alloys
NICKEL	Nickel-Base Alloys
STAIN. STEEL	Stainless Steel Alloys
ALLOY STEEL	Steel Alloys

TABLE 1.5

ABBREVIATIONS FOR ALLOY CONDITIONING AND HEAT TREATMENTS

Abbreviation	Condition/Heat Treatment
OQ	Oil Quenched
ABQ	Aus-Bay Quench
AC	Air Cool
WC	Water Quench
MA	Mill Anneal
BA	Beta Anneal
DA	Duplex Anneal
RA	Recrystallize Anneal
ST	Solution Treated
STA	Solution Treated And Aged

TABLE 1.6

ABBREVIATIONS FOR PRODUCT FORMS

Abbreviations	Product Form
S	Sheet
P	Plate
E	Extrusion
F	Forging
FB	Forged Bar
BT	Billet
BR	Round Bar
RB	Rolled Bar
C	Casting
W	Weldment
D	Disk
EB	Extruded Bar
B	Bar

TABLE 1.7

ABBREVIATIONS FOR ENVIRONMENTAL SYSTEMS

Abbreviations	Environmental System
R. T.	Room Temperature (65°F-80°F)
L. H. A.	Low Humidity Air (< 10% RH)
Dry Air	Low Humidity Air (< 10% RH)
H. H. A.	High Humidity Air (> 80% RH)
Lab. Air	Laboratory Air (% RH unspecified)
Dist. H_2O	Distilled Water
Dist. Water	Distilled Water
3.5 PCT Nacl	3.5% Salt Water Solution
JP.4	JP-4 Aircraft Fuel
JP.4 - Fuel	JP-4 Aircraft Fuel
S. T. W.	Sump Tank Water
S. S. W.	Simulated Sea Water
S. C. S.	Shop Cleaning Solvent
F. C. S.	Field Cleaning Solvent
Salt Fog	Salt Fog
Temp.	Temperature

TABLE 1.8

ABBREVIATIONS FOR SPECIMEN DESIGNS

Abbreviations	Specimen Design*
CT	Compact Tension
NB	3Pt. Notched Bend
WOL	Wedge Open Load
CCP	Center Cracked Panel
BWOL	Bolt Loaded-Wedge Open Load
CANT	Cantilever Beam
TDCB	Tapered Double Cantilever Beam
CHAR	Charpy
PTSC	Part Through Surface Crack
SENT	Single Edge Notch Tension
K_BBAR	K_B Bar
4-NB	4 Pt. Notched Bend
MCT	Modified Compact Tension
CNT	Center Notched Tension
DCB	Double Cantilever Beam
BDCB	Bolt Loaded Double Cantilever Beam

*Also note that when "SG" is used in conjunction with a specimen design, the specimen is side-grooved along the path of the crack.

Volume 2

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CHAPTER 6   ALLOY STEELS

CHAPTER 5

NICKEL BASE ALLOY SECTIONS

Table 5.0.1

AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
ASTROLOY P/M-H	2025F 3HR AC,1600F 8HR AC,1800F 4HR AC,1200F 24HR AC,1400F 8HR AC	DISK				X		
ASTROLOY P/M-W	2025F 4HRS AC, 1600F 8HRS AC, 1800F 4HRS AC, 1200F 24HRS AC, 1400F 8HRS AC	DISK				X		
ASTROLOY 901	----	----				X		
INCOLOY 901	----	----				X		
INCONEL 600	1585F .75HR AC	PLATE				X		
	1585F .75HR AC, 1000F, 1B8001RS	PLATE				X		
	1585F .79HR AC, 1200F 1450 HRS	PLATE				X		
INCONEL 625	MA	PLATE				X		
INCONEL 718	COLD ROLLED 30 PERCENT AND AGED	SHEET		X				
	ST 1850F, 1360F 9HRS F/C 1175F	FORGED BAR				X		
	1325F 8 HR, FC TO 1150F, HOLD 18 HR	FORGING	X					
	1325F 8HRS, FC TO 1150F	FORGING	X					
	1325F 9 HR, FC TO 1150F AT 100F/HR.HOLD AT 1150F 8 HR, AC	FORGING				X		
	1730F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR 1HOLD B1R. AC	DISK				X		

Table 5.0.1 (con't)

AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
INCONEL 718	1750F, AC, 1325F, 8HRS, FC TO 1130F, HELD 18HRS, AC	SHEET				x		
		PLATE				x		
		FORGING				x		
		FORGED BAR				x		
	1750F, 1HR, AC 1325F, 8HRS, FC TO 1150F, HELD 18HRS, AC (VIM-EFR)	PLATE				x		
	1750F, 1HR, AC 1325F, 8HRS, FC TO 1130F, HELD 18HRS, AC (VIM-VAR)	FORGED BAR				x		
	1760F 1HR WQ, 1325F 8HRB, FC TO 1150F 8HRS, AC	DISK				x		
	1800F 1HR Q, 1325F 8HRB FC TO 1150F HOLD 8HRS AC	FORGING				x		
	1850F 1.5HR DQ,1360F 9HRS, FC TO 1175F	FORGED BAR						x
	1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	SHEET						x
	1950F, AC, 1325F, 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE				x		
IN100	------	------				x		
		FORGING				x		
	PRESTRAIN	FORGING				x		
IN100 P/M-G	2050F 2HRS DQ, 1600F 0.67HR AC, 1200F 24HRS AC, 1400F 4HRS AC	DISK				x		
NASA IIB-7 P/M	1650F 16HRS TO 2000F 1HR DQ, 1400F 16HRS AC	DISK				x		

Table 5.0.1 (con't)

AVAILABLE DATA FOR NICKEL-BASE SUPERALLOYS

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
P/M RENE 95	2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC	DISK				X		
	2100F 1HR, SQ AT 1000F, 1600F 1HR, 1200F 24HRS, AC	DISK				X		
RENE 95 (H&F)	2000F 1HR, SQ AT 1000F, 1400F 16HRS	FORGING				X		
WASPALOY	-----	----- FORGING				X	X	
	1850F 2HRS, 1350F 6HRS, (FINE GB, SMALL PRECIPITATES)	BILLET				X		
	1850F 2HRS, 1600F 24HRS (FINE GB, LARGE PRECIPITATES)	BILLET				X		
	1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC	DISK				X		
	2010F 2HRS, 1350F 6HRS, (COARSE GS, SMALL PRECIPITATES)	BILLET				X		
	2010F 2HRS, 1600F 24HRS, (COARSE GS, LARGE PRECIPITATES)	BILLET				X		

TABLE 5.0.2

PLANE STRESS AND TRANSITIONAL FRACTURE TOUGHNESS
OF NICKEL BASE ALLOYS (WITHOUT BUCKLING CONSTRAINTS)

Alloy	Condition/HT	Test Temp. (°F)	Specimen Orient	Specimen Width (in)	Yield Strength (KSI)	Specimen Thickness (in) = 0.027	K_c^* (Ksi $\sqrt{in}$)
Inconel 718	Cold Rolled 30 Percent and aged	-423	L-T	4.0	269.0		191.1/7.5 (15)
		-320	L-T	4.0	259.0		200.6/13.8 (13)
		R.T.	L-T	4.0	218.0		178.5/3.6 (6)
				18.0	218.0		224.6/11.1 (5)

*Mean/Standard Deviation (No. of Specimens)

Table 5.0.3.1

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE
STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN
ORIENTATION: Unknown

STRESS RATIO: 0.05-0.10

ENVIRONMENT: LAB AIR AT R.T.

FREQUENCY: 10.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
INCONEL 718	1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	PLATE	0.05	10.00				1.77	44.1	
	1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGING	0.05	10.00				1.77	41.7	
	1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-EFR)	PLATE	0.05	10.00				1.57		
WASPALOY	1850F 2HRS, 1350F 4HRS(FINE GS, SMALL PRECIPITATES)	BILLET	0.10	10.00					10.7	
	2010F 2HR, 1350F 4HR(COARSE GS, SMALL PRECIPITATES)	BILLET	0.10	10.00					2.84	
	2010F 2HR, 1600F 24HR(COARSE GS, LARGE PRECIPITATES)	BILLET	0.10	10.00					9.65	

Table 5.0.3.2

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE
STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN
ORIENTATION: L-T
STRESS RATIO: 0.05

ENVIRONMENT: LAB AIR AT R.T.

FREQUENCY: 8.33HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
INCONEL 718	1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	8.33					1.29	30.4
	1950F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	8.33					1.05	

Table 5.0.3.3

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN
ORIENTATION: T-L

STRESS RATIO: 0.05

ENVIRONMENT: LAB AIR AT R.T.

FREQUENCY: 8.33-10.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
INCONEL 718	1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-VAR)	FORGED BAR	0.05	8.33-10.00				2.99	122.	

5.0-9

Table 5.0.3.4

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE
STRESS INTENSITY FACTOR FOR NICKEL-BASE SUPERALLOYS

TEST CONDITIONS:

SPECIMEN
ORIENTATION: C-R   ENVIRONMENT: LAB AIR AT R.T.

STRESS RATIO: 0.00-0.05   FREQUENCY: 0.33-10.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
INCONEL 718	1750F AC. 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGED BAR	0.05	10.00				2.55	47.2	
	1760F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC	DISK	0.00	.33				2.86		
P/M RENE 95	2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC	DISK	0.00	.33				.394	27.6	

TABLE 5.0.4

INDIVIDUAL STRESS CORROSION CRACKING THRESHOLD DATA FOR NICKEL BASE ALLOYS AT ROOM TEMPERATURE

$$K_{Iscc} \text{ (Ksi}\sqrt{\text{in}}\text{)}$$

ENVIRONMENTS

ALLOY	CONDITION	PRODUCT FORM	SPECIMEN ORIENTATION	SHOP CLEANING SOLVENT	SUMP TANK WATER	AEROZINE 50	MARTIN-MARIETTA REFINED GRADE HYDRAZINE	MATHESON-COLEMAN-BELL 97% GRADE HYDRAZINE	PROPELLANT GRADE HYDRAZINE
INCONEL 718	1850 1.5 HR OQ, 1360F 9 HRS, FC to 1175F	FB	L-T	>166.0;>86.0	>86.0;>180.0				
		FB	T-L		>89.0;121.0				
		FB	S-L		>87.0;>99.0				
	1880F 1 HR AC, 1520F 8 HR FC, 1200F 16 HR AC	S	---			80.0	79.0;79.0	25.8	87.5

Table 5.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE ASTROLOY P/M-H

ENVIRONMENT: AIR AT 1200 F

TEST CONDITIONS:

SPECIMEN
ORIENTATION: C-R

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)						
					2.5	5	10	20	30	50	100
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	2 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM							173	
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	5 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM							181	
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM							314	
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	0.01							275	
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	0.33					7.93		84.4	
2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	20.00					4.53			

TABLE 5.1.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.1.3.1 INDICATING EFFECT
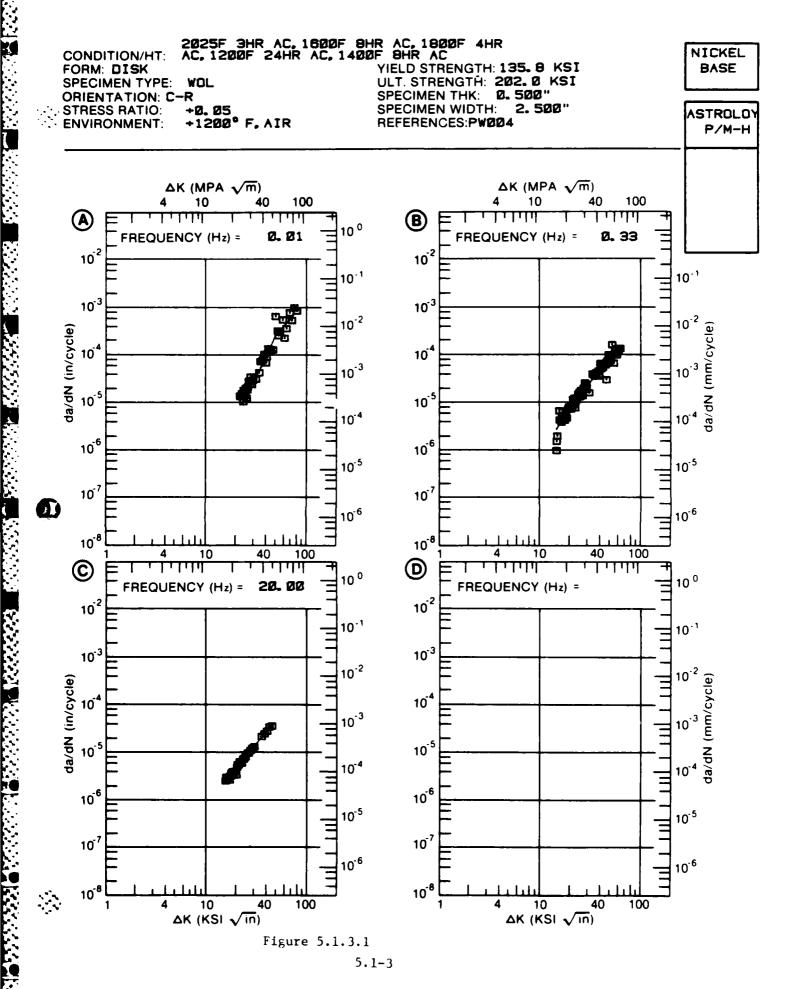
OF FREQUENCY

MATERIAL: NICKEL BASE   ASTROLOY   P/M-H
CONDITION: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR
           AC, 1200F 24HR AC, 1400F 8HR AC

ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.01	F(HZ)= 0.33	F(HZ)= 20.00	
DELTA K MIN	A: 21.63	12.0			
	B: 14.25		2.67		
	C: 15.27			2.39	
	D:				
	16.00		3.95	2.64	
	20.00		7.93	4.53	
	25.00	18.4	14.9	8.25	
	30.00	31.2	24.2	13.6	
	35.00	54.7	35.7	20.2	
	40.00	103.	49.4	27.8	
	50.00	275.	84.4		
	60.00	410.	130.		
	70.00	582.			
	80.00	1085.			
DELTA K MAX	A: 80.05	1089.			
	B: 62.12		142.		
	C: 44.64			35.6	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	33.43	24.73	8.73

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC

FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 135.8 KSI
ULT. STRENGTH: 202.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

ASTROLOY P/M-H

Figure 5.1.3.1

5.1-3

TABLE 5.1.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
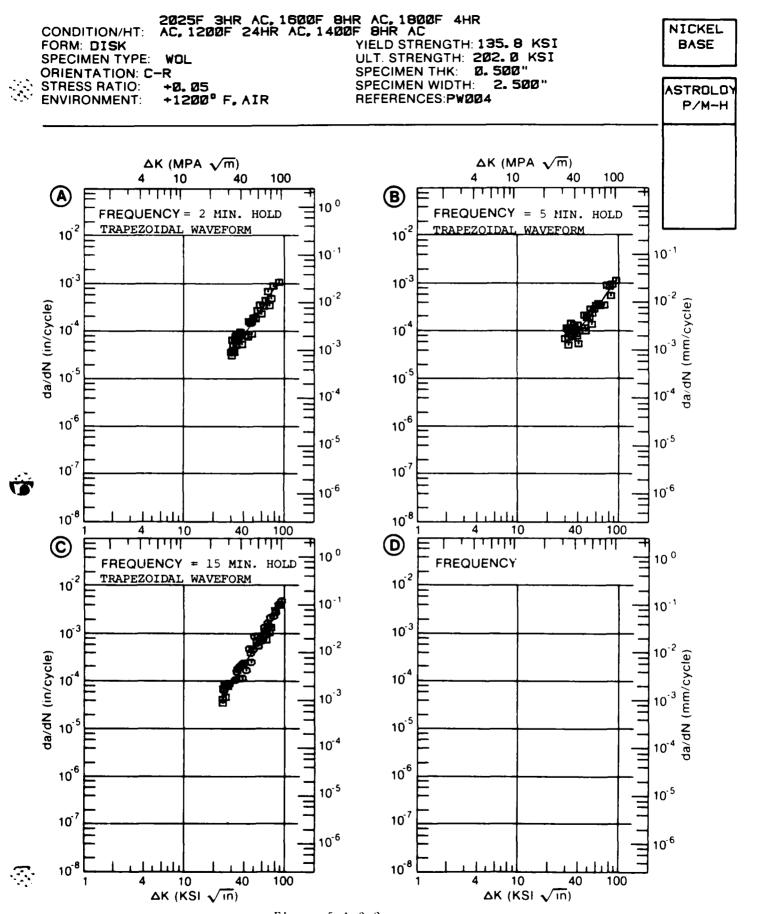
DATA ASSOCIATED WITH FIGURE 5.1.3.2 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   ASTROLOY P/M-H
CONDITION: 2025F 3HR AC,1600F 8HR AC,1800F 4HR
          AC,1200F 24HR AC,1400F 8HR AC

ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F=2 MIN HOLD TRAPEZOIDAL	F=5 MIN HOLD TRAPEZOIDAL	F=15 MIN HOLD TRAPEZOIDAL	
DELTA K MIN	A: 29.04	38.9			
	B: 28.95		90.9		
	C: 23.79			60.7	
	D:				
	25.00			64.9	
	30.00	43.3	90.1	97.1	
	35.00	65.5	95.9	156.	
	40.00	90.0	114.	246.	
	50.00	173.	181.	514.	
	60.00	327.	298.	926.	
	70.00	559.	472.	1574.	
	80.00	842.	708.	2622.	
	90.00		1000.	4352.	
DELTA K MAX	A: 87.40	1050.			
	B: 93.51		1113.		
	C: 92.44			4928.	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		26.66	26.49	24.65	

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 2025F 3HR AC, 1600F 8HR AC, 1800F 4HR
AC, 1200F 24HR AC, 1400F 8HR AC

FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 135.8 KSI
ULT. STRENGTH: 202.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW004

NICKEL
BASE

ASTROLOY
P/M-H

Figure 5.1.3.2

5.1-5

Table 5.2.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE ASTROLOY P/M-W

TEST CONDITIONS:

SPECIMEN
ORIENTATION: C-R

ENVIRONMENT: AIR AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
2025F 4HR AC, 1600F 8HR AC, 1800F 4IR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM					50.2	1155	
2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	0.33					10.3	132	
2025F 4HR AC, 1600F 8HR AC, 1800F 4HR AC, 1200F 24HR AC, 1400F 8HR AC	DISK	0.05	20.00					3.48		

TABLE 5.2.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.2.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   ASTROLOY   P/M-W
CONDITION: 2025F 4HR AC, 1600F 8HR AC, 1800F 4HR
          1200F 24HR AC, 1400F 8HR AC

ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F=15 MIN HOLD TRAPEZOIDAL	F(HZ)= 0.33	F(HZ)= 20.00	
A: 15.46		18.2			
DELTA K B: 12.48			3.50		
MIN C: 16.61				2.59	
D:					
13.00			3.61		
16.00		21.0	5.26		
20.00		50.2	10.3	3.48	
25.00		113.	21.7	5.84	
30.00		218.	37.7	9.22	
35.00		373.	55.9	13.6	
40.00		578.	76.5	18.8	
50.00		1156.	132.		
60.00		2205.	225.		
70.00		4714.			
80.00		14680.			
A: 84.92		30709.			
DELTA K B: 61.82			249.		
MAX C: 45.34				25.4	
D:					

ROOT MEAN SQUARE PERCENT ERROR	97.51	14.52	15.84

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT. 2025F 4HR AC.1600F 8HR AC.1800F 4HR AC
.1200F 24HR AC. 1400F 8HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YiELD STRENGTH: 153.0 KSI
ULT. STRENGTH: 220.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW004

NICKEL
BASE

ASTROLOY
P/M-W

Figure 5.2.3.1

5.2-3

TABLE 5.3.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:
ENVIRONMENT: R.T. , LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10			
A: 18.88	:	.752			
DELTA K B:	:				
MIN C:	:				
D:	:				
20.00	:	1.12			
25.00	:	2.62			
30.00	:	4.55			
35.00	:	6.35			
40.00	:	8.55			
50.00	:	22.1			
A: 59.15	:	35.1			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   11.20
 PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0. 17 HZ
ENVIRONMENT: R. T. , LAB AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0. 126"
SPECIMEN WIDTH: 2. 500"
REFERENCES:PW003

Figure 5.3.3.1

TABLE 5.3.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
A: 16.50		1.99			
DELTA K B: 9.87			.867		
MIN C:					
D:					
10.00			1.21		
13.00			2.25		
16.00			3.72		
20.00		3.58	5.85		
25.00		7.14	9.39		
30.00		12.0	15.3		
35.00		18.9	23.7		
40.00		27.7	34.2		
50.00		50.0			
60.00		87.1			
70.00		172.			
80.00		402.			
A: 88.23		918.			
DELTA K B: 48.57			54.2		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		21.41	14.70		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F, AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.121-   0.124"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003
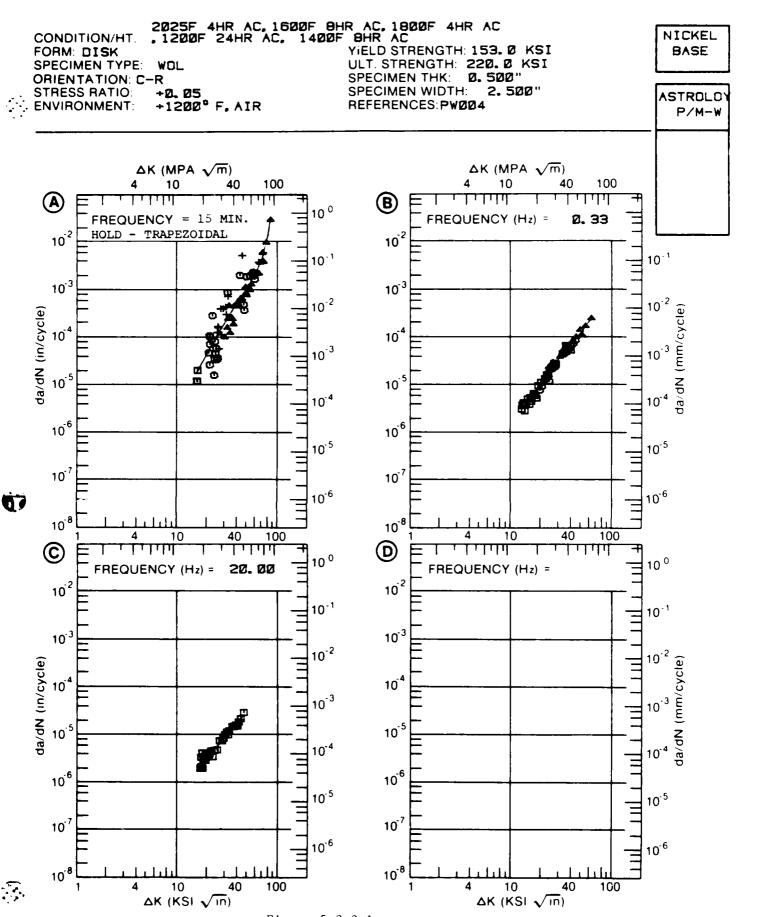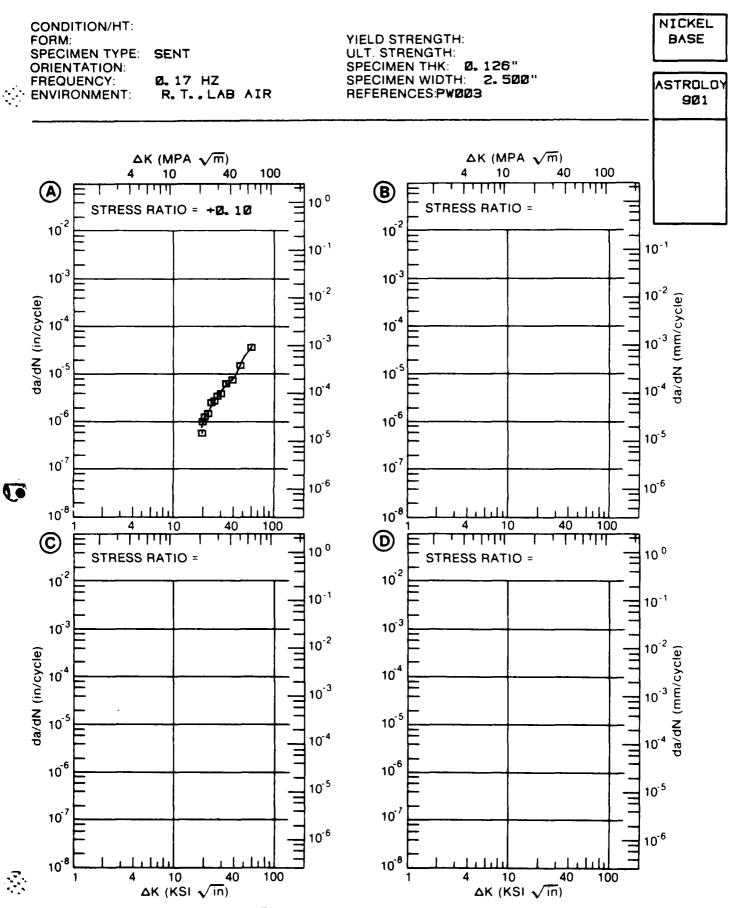
NICKEL
BASE

ASTROLOY
901

Figure 5.3.3.2

5.3-5

TABLE 5.3.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.70			
A: 8.01	:	.441			
DELTA K B:	:				
MIN C:	:				
D:	:				
9.00	:	.428			
10.00	:	.601			
13.00	:	1.44			
16.00	:	2.26			
20.00	:	3.93			
25.00	:	5.98			
A: 26.83	:	7.68			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   14.00
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 30.00 HZ
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH:
ULT STRENGTH:
SPECIMEN THK. 0.123"
SPECIMEN WIDTH 2.500"
REFERENCES PW003
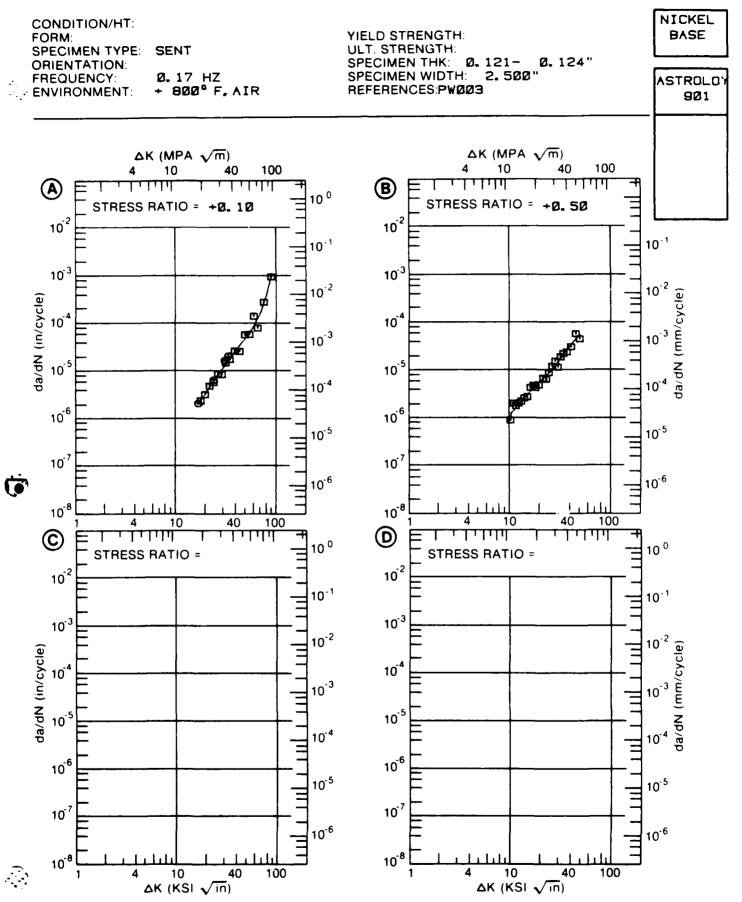
NICKEL
BASE

ASTROLOY
901

Figure 5.3.3.3

5.3-7

TABLE 5.3.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY 901
CONDITION:
ENVIRONMENT: + 950F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10	R=+0.50	R=+0.80	
DELTA K MIN	A:	14.98	1.53			
	B:	13.38		1.60		
	C:	8.44			.948	
	D:					
		9.00			1.64	
		10.00			2.08	
		13.00			3.12	
		16.00	3.15	4.57	5.03	
		20.00	6.81	10.0	7.69	
		25.00	10.6	15.6		
		30.00	15.8	20.7		
		35.00	22.1	27.7		
		40.00	30.4	39.7		
		50.00	65.5			
		60.00	151.			
		70.00	191.			
DELTA K MAX	A:	71.72	182.			
	B:	42.89		50.9		
	C:	24.05			11.9	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			18.21	16.75	12.71	

LIFE   0.0-0.5
PREDICTION 0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 950° F. AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.117- 0.123"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003
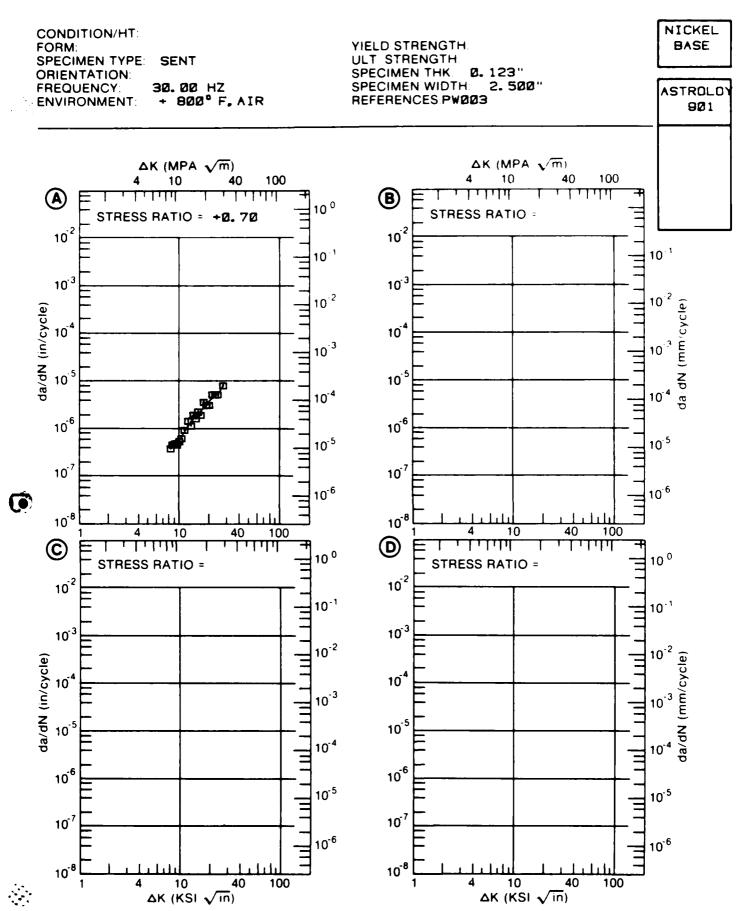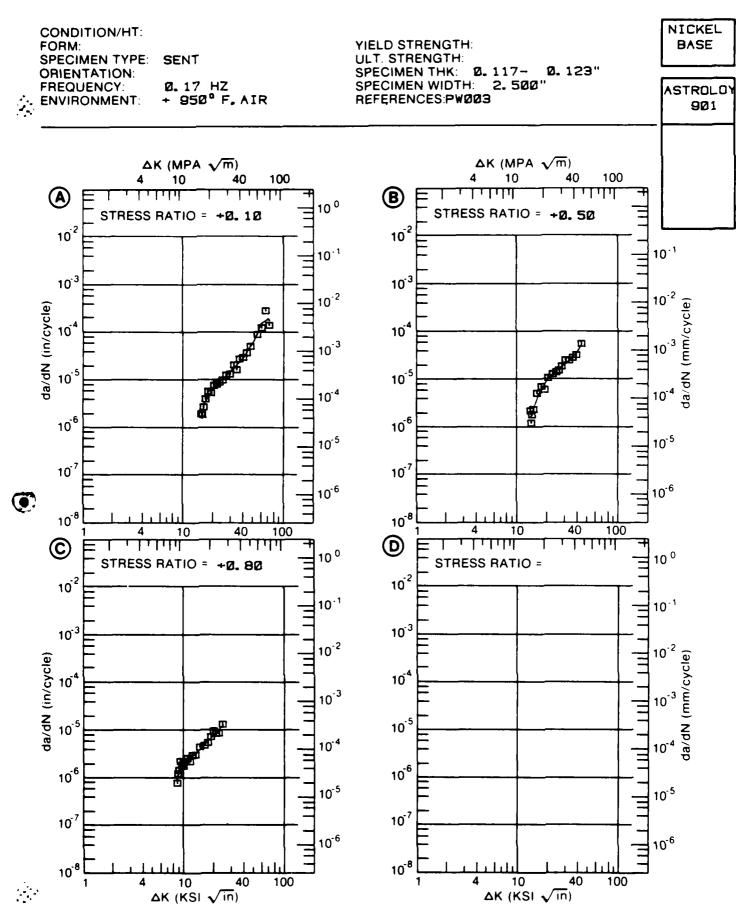
NICKEL BASE

ASTROLOY 901

Figure 5.3.3.4

5.3-9

TABLE 5.3.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.5   INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:
ENVIRONMENT: +1100F, AIR

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	R=+0.10	R=+0.50		
A: 17.59	7.88			
DELTA K B: 15.58		5.64		
MIN C:				
D:				
16.00		6.02		
20.00	11.4	11.4		
25.00	19.3	20.2		
30.00	27.9	26.9		
35.00	37.0	35.0		
40.00	47.3	50.9		
50.00	78.0			
60.00	139.			
A: 67.44	249.			
DELTA K B: 48.57		110.		
MAX C:				
D:				

ROOT MEAN SQUARE PERCENT ERROR	14.45	13.87

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0. 17 HZ
ENVIRONMENT: +1100° F. AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0. 122"
SPECIMEN WIDTH: 2. 500"
REFERENCES PW003
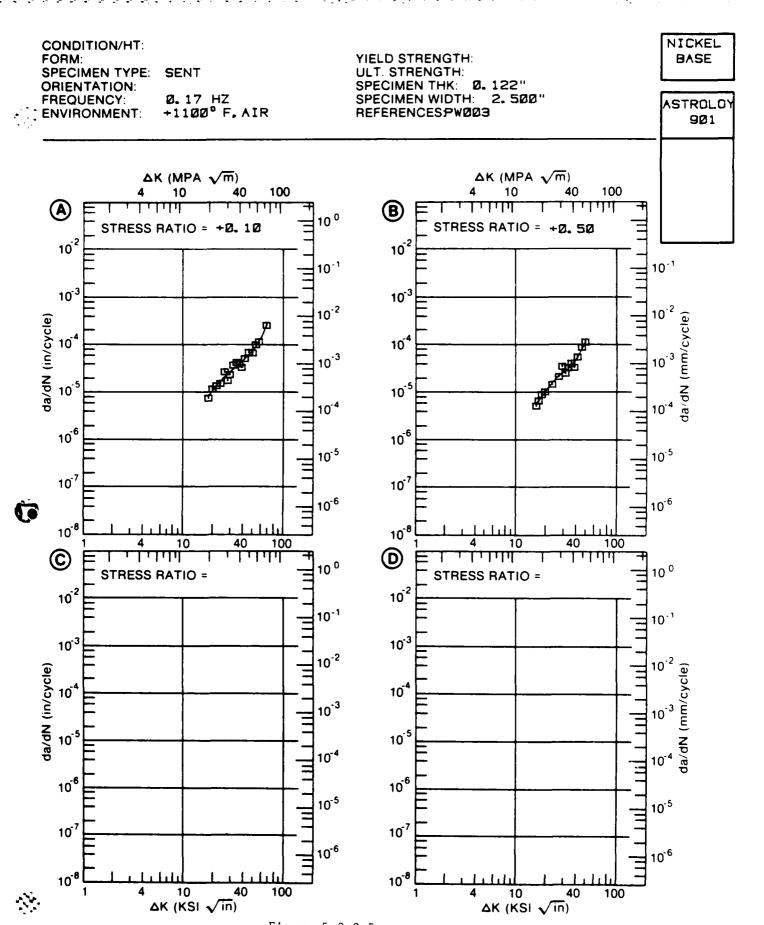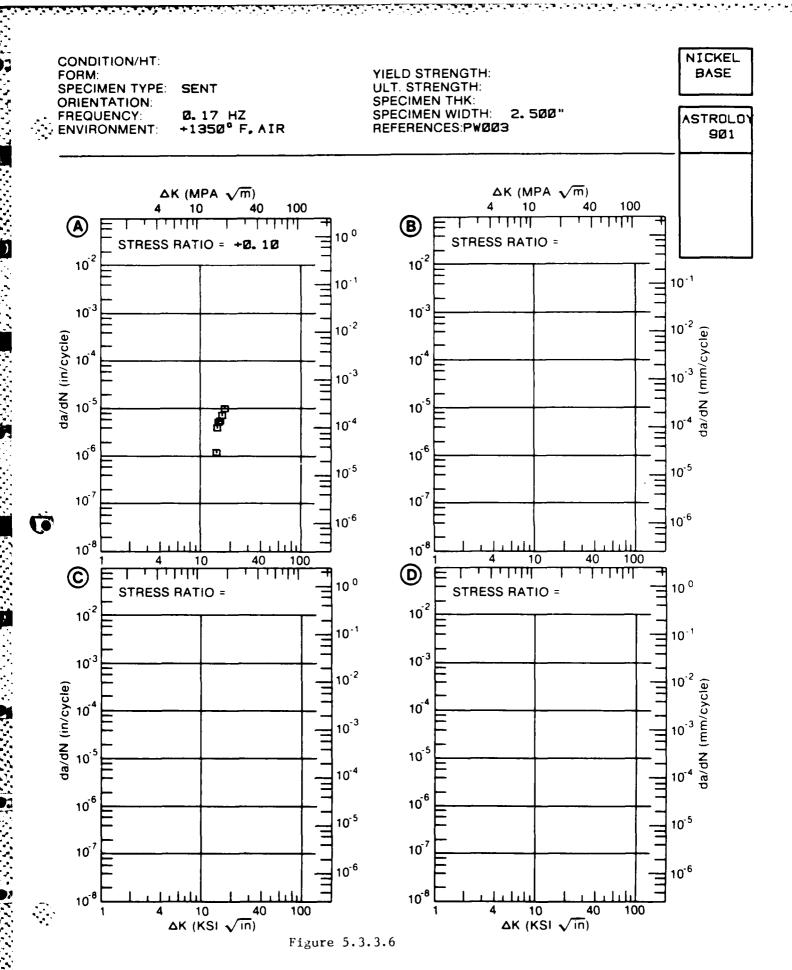
NICKEL BASE

ASTROLOY 901

Figure 5.3.3.5

5.3-11

TABLE 5.3.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.6 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:
ENVIRONMENT: +1350F, AIR

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	R=+0.10			

DELTA K A:	:	
MIN B:	:	
C:	:	
D:	:	
200.00	:	

A:	:	
DELTA K B:	:	
MAX C:	:	
D:	:	

ROOT MEAN SQUARE   0.00
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1350° F. AIR

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

Figure 5.3.3.6

TABLE 5.3.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   ASTROLOY   901
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+800F AIR	E=+1100F AIR		
DELTA K MIN A: 10.86	:	1.81			
B: 11.04	:		4.57		
C:	:				
D:	:				
13.00	:	2.58	5.22		
16.00	:	3.71	10.9		
20.00	:	5.96	16.6		
25.00	:	9.97	24.6		
30.00	:	13.8	35.1		
35.00	:	19.9	37.8		
40.00	:	29.4			
DELTA K MAX A: 45.80	:	37.3			
B: 36.86	:		35.6		
C:	:				
D:	:				
ROOT MEAN SQUARE PERCENT ERROR		11.65	15.60		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION: C-R
STRESS RATIO: +0.50
FREQUENCY: 0.17 HZ

YIELD STRENGTH:
ULT STRENGTH:
SPECIMEN THK: 0.122"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

Figure 5.3.3.7

TABLE 5.3.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.3.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE ASTROLOY 901
CONDITION:

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)					
		A	B	C	D
		E=+ 800F	E=+1100F		
		AIR	AIR		
A:	8.97	.504			
DELTA K B:	7.57		.560		
MIN C:					
D:					
	8.00		.661		
	9.00	.504	.894		
	10.00	.567	1.12		
	13.00	1.23	1.82		
	16.00		2.78		
	20.00		5.32		
	25.00		14.3		
A:	15.69	1.88			
DELTA K B:	25.23		15.0		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		9.84	17.19		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: SENT
ORIENTATION:
STRESS RATIO: +0.70
FREQUENCY: 30.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.119- 0.123"
SPECIMEN WIDTH: 2.500"
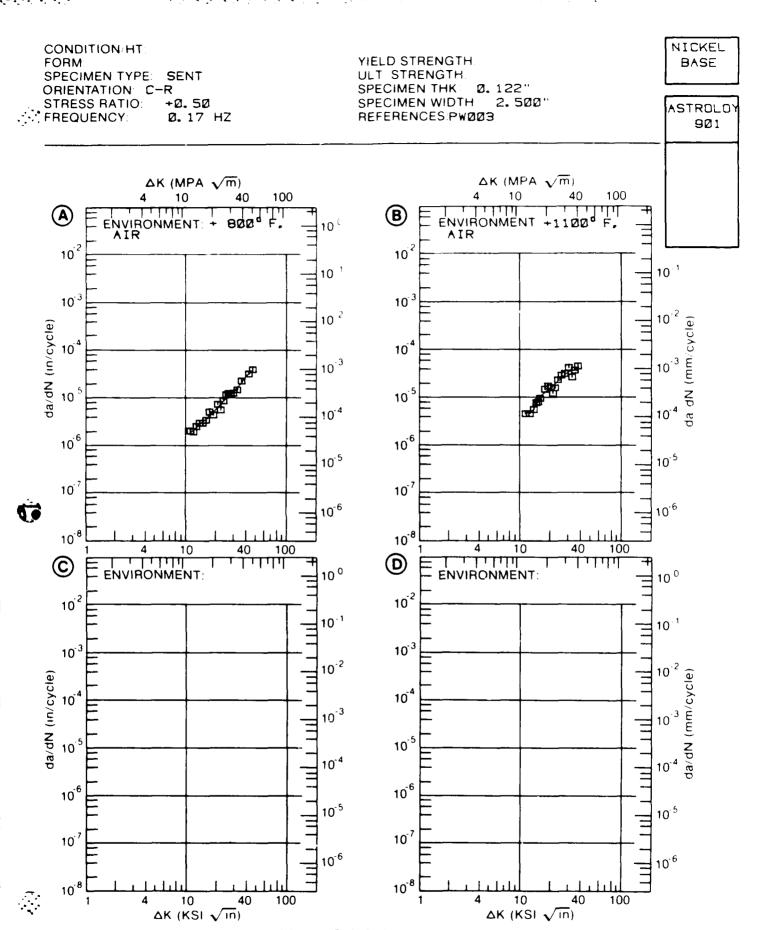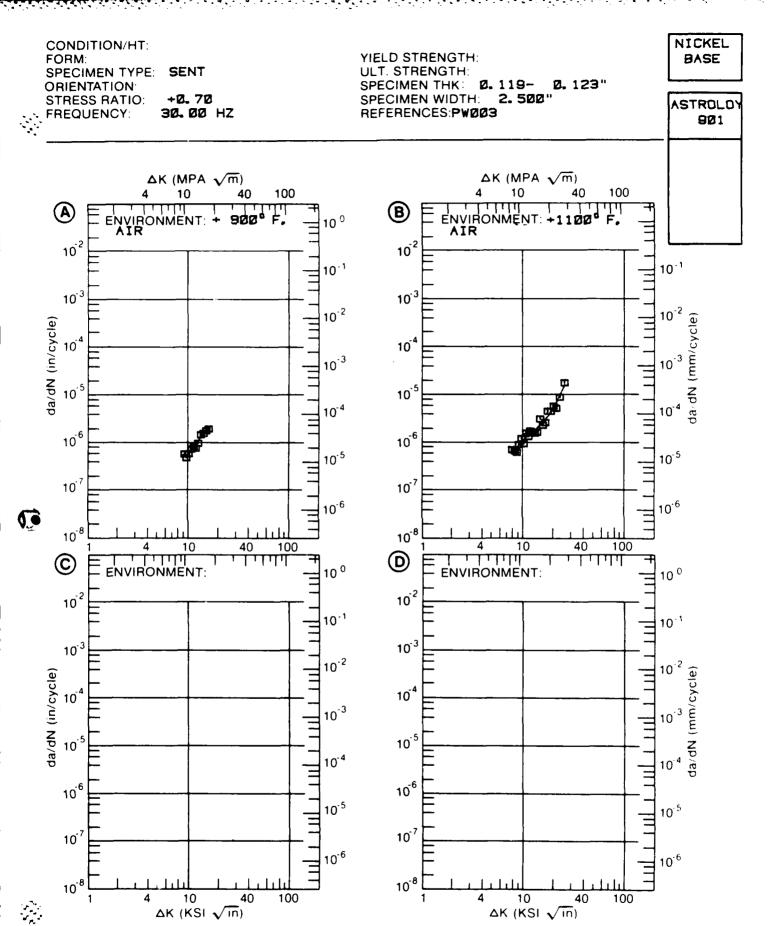REFERENCES:PW003

NICKEL BASE

ASTROLOY 901

Figure 5.3.3.9

TABLE 5.4.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.4.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCOLOY 901
CONDITION:

| DELTA K | | DA/DN (10**-6 IN./CYCLE) | | | |
(KSI*IN**1/2)		A	B	C	D
		E=+ 900F			
		AIR			
DELTA K MIN A: 14.89		.779			
DELTA K MIN B:					
DELTA K MIN C:					
DELTA K MIN D:					
	16.00	1.00			
	20.00	2.20			
	25.00	4.87			
	30.00	9.23			
	35.00	15.6			
	40.00	24.3			
	50.00	48.7			
DELTA K MAX A: 56.30		68.7			
DELTA K MAX B:					
DELTA K MAX C:					
DELTA K MAX D:					

ROOT MEAN SQUARE   23.65
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.500"
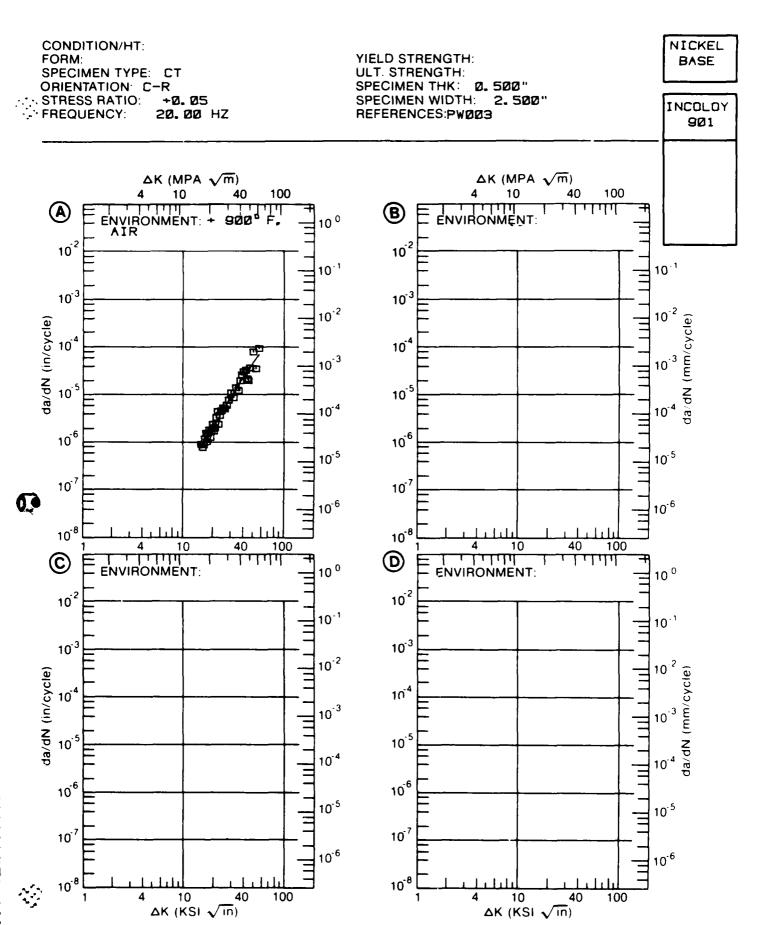SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL
BASE

INCOLOY
901

Figure 5.4.3.1

5.4-3

Table 5.5.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 600

ENVIRONMENT: AIR AT 800 F

TEST CONDITIONS

SPECIMEN
ORIENTATION: Unknown

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))							
							FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100		
1585F 75HR AC	PLATE	0.05	6.67				1.71				
1585F 75HR AC	PLATE	0.33	6.67				3.91				
1585F 75HR AC	PLATE	0.60	6.67			0.54					

5.5-1

Table 5.5.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 600

TEST CONDITIONS:

SPECIMEN
ORIENTATION: Unknown

ENVIRONMENT: AIR
AT 1000 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1585F 75HR AC	PLATE	0.05	6.67					3.85		
1585F 75HR AC	PLATE	0.05	0.67					4.60		
1585F 75HR AC	PLATE	0.33	6.67					6.55		
1585F 75HR AC	PLATE	0.50	6.67				0.86			
1585F 75HR AC	PLATE	0.66	6.67				0.68			
1585F 75HR AC, 1000F 18000 HRS	PLATE	0.05	0.67					4.81		

TABLE 5.5.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F .75HR AC
ENVIRONMENT: R.T. ,AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.05			
DELTA K MIN	A:	25.33	2.73			
	B:					
	C:					
	D:					
		30.00	5.03			
		35.00	10.3			
		40.00	18.7			
DELTA K MAX	A:	40.56	19.8			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	5.08

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 5.00 HZ
ENVIRONMENT: R. T., AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.390"
SPECIMEN WIDTH: 2.000"
REFERENCES:HD003
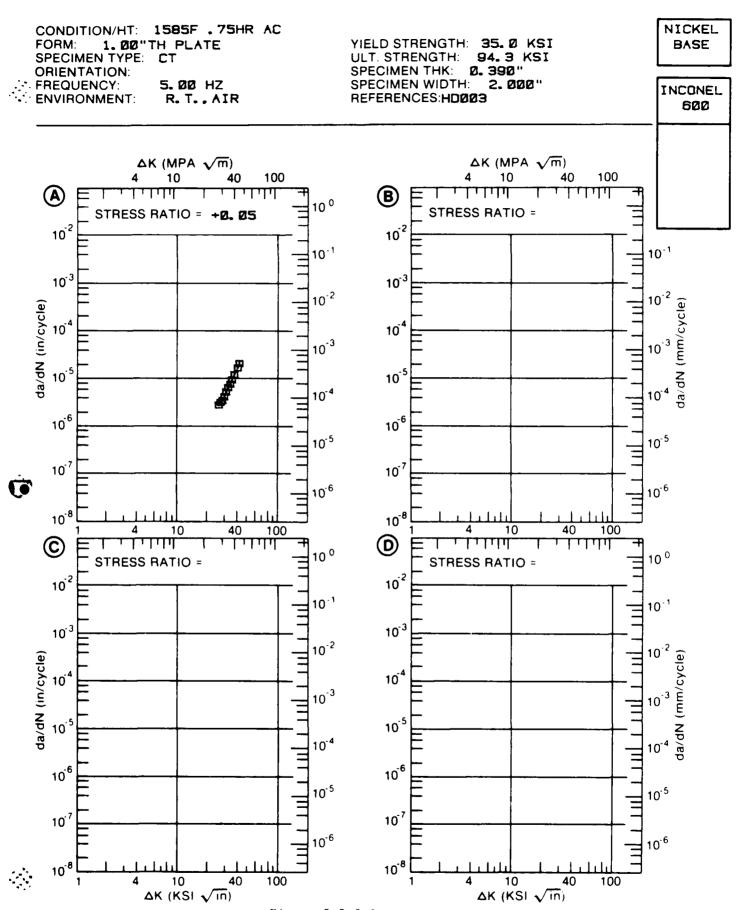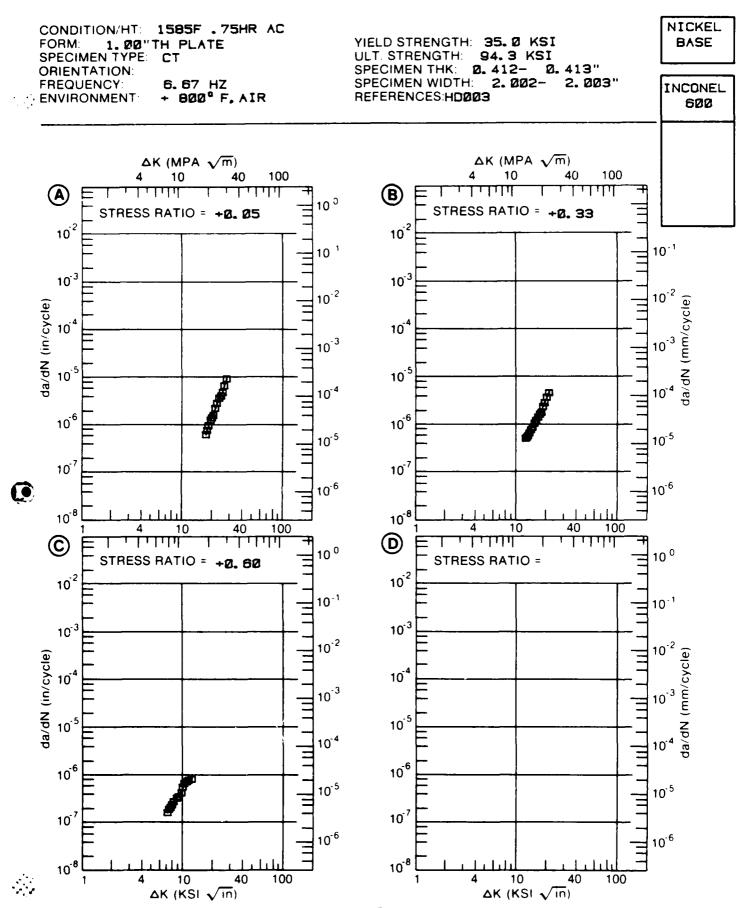
NICKEL BASE

INCONEL 600

Figure 5.5.3.1

5.5-5

TABLE 5.5.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F .75HR AC
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05	R=+0.33	R=+0.60	
A:	16.89	.630			
DELTA K B:	12.17		.490		
MIN C:	6.90			.172	
D:					
	7.00			.176	
	8.00			.250	
	9.00			.379	
	10.00			.547	
	13.00		.623		
	16.00		1.35		
	20.00	1.71	3.91		
	25.00	5.41			
A:	27.20	9.04			
DELTA K B:	20.75		4.85		
MAX C:	12.06			.818	
D:					

| ROOT MEAN SQUARE PERCENT ERROR | | 7.02 | 8.23 | 7.41 | |

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 6.67 HZ
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.412- 0.413"
SPECIMEN WIDTH: 2.002- 2.003"
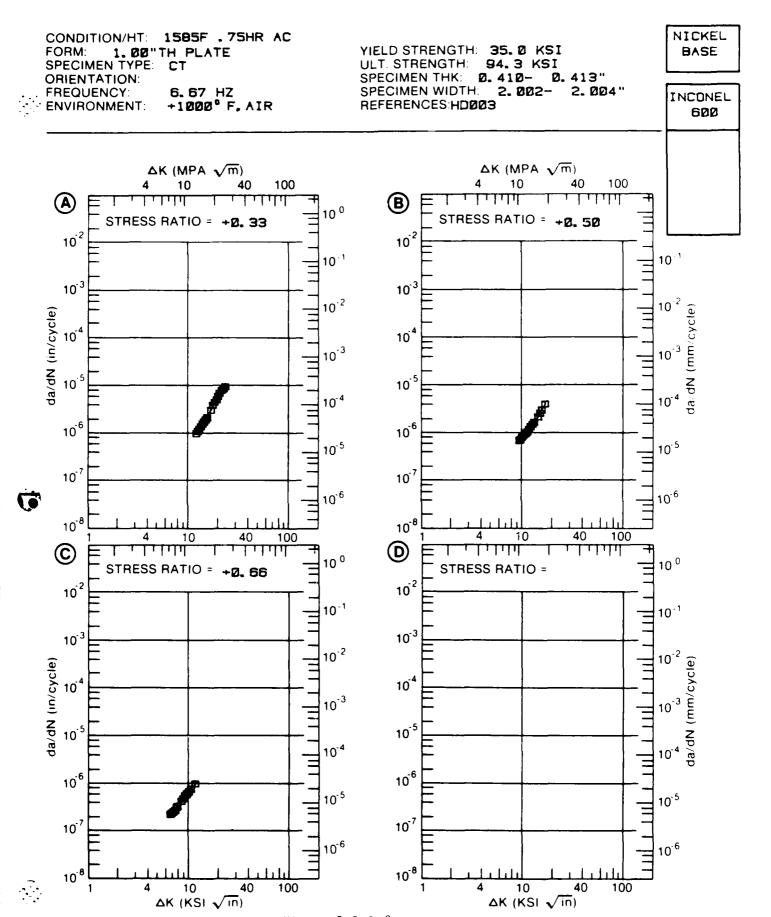REFERENCES:HD003
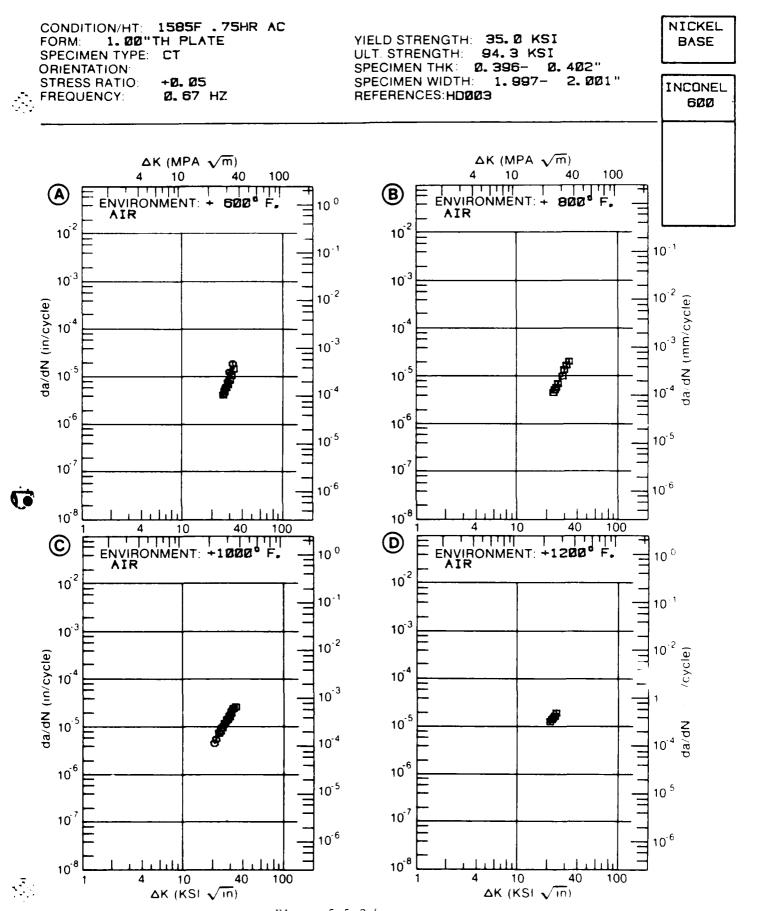
NICKEL
BASE

INCONEL
600

Figure 5.5.3.2

5.5-7

TABLE 5.5.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F .75HR AC
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)		:	DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.33	R=+0.50	R=+0.66	
	A: 11.70	:	1.02			
DELTA K	B: 9.14	:		.688		
MIN	C: 6.43	:			.208	
	D:	:				
	7.00	:			.255	
	8.00	:			.366	
	9.00	:			.512	
	10.00	:		.861	.684	
	13.00	:	1.32	1.73		
	16.00	:	2.79	3.53		
	20.00	:	6.55			
	A: 22.90	:	9.57			
DELTA K	B: 16.53	:		4.03		
MAX	C: 11.40	:			.941	
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	4.59	4.43	2.38

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 6.67 HZ
ENVIRONMENT: +1000° F. AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.410- 0.413"
SPECIMEN WIDTH: 2.002- 2.004"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

Figure 5.5.3.3

TABLE 5.5.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F   75HR AC

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
DELTA K MIN	A:	25.08	4.25			
	B:	22.56		4.60		
	C:	19.93			4.54	
	D:					
		20.00			4.60	
		25.00		6.72	11.1	
		30.00	11.5	15.2	20.9	
DELTA K MAX	A:	31.85	17.2			
	B:	32.19		20.8		
	C:	32.64			27.5	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			15.37	5.28	4.51	0.00

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	2	1	2	
1.25-2.0				
>2.0				

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.396- 0.402"
SPECIMEN WIDTH: 1.997- 2.001"
REFERENCES: HD003

NICKEL BASE

INCONEL 600

Figure 5.5.3.4

TABLE 5.5.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.5 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   INCONEL 600
CONDITION: 1585F .75HR AC
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.001	F(HZ)= 0.07	F(HZ)= 6.67	
	A:				
DELTA K B:	20.04		6.75		
MIN C:	16.50			1.55	
D:					
	20.00			3.85	
	25.00		12.8	11.8	
	30.00		24.1	22.9	
	A:				
DELTA K B:	32.54		30.6		
MAX C:	30.56			23.9	
D:					
ROOT MEAN SQUARE PERCENT ERROR		0.00	3.86	7.59	
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25		1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1585F .75HR AC
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
ENVIRONMENT: +1000° F. AIR

YIELD STRENGTH: 35.0 KSI
ULT. STRENGTH: 94.3 KSI
SPECIMEN THK: 0.412- 0.420"
SPECIMEN WIDTH: 2.002- 2.004"
REFERENCES:HD003
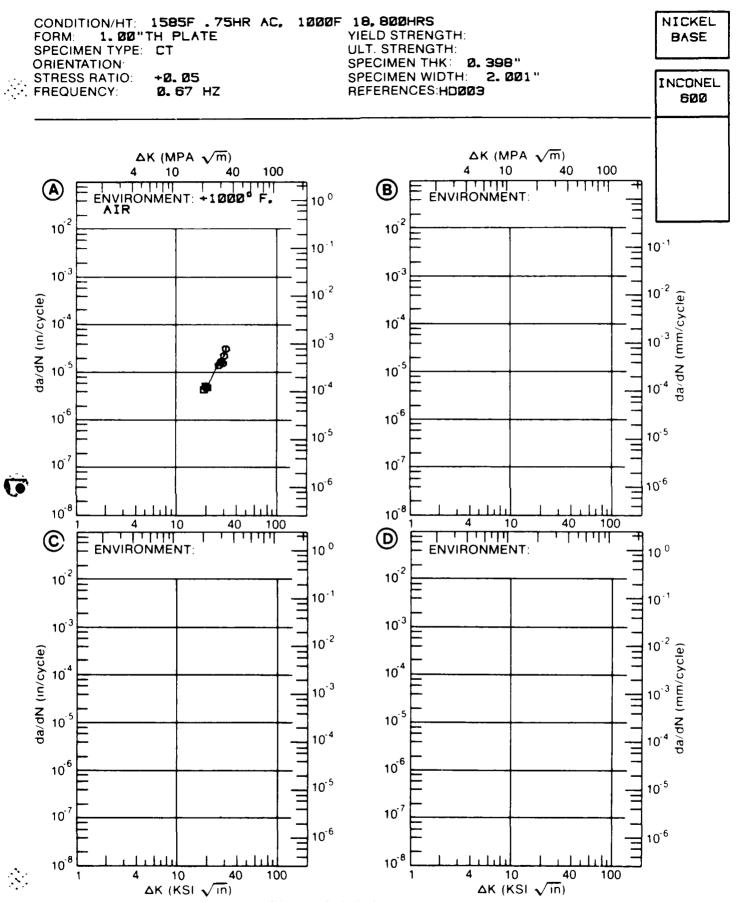
NICKEL
BASE

INCONEL
600

Figure 5.5.3.5

5.5-13

TABLE 5.5.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F   75HR AC, 1000F 18,800HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1000F			
	:AIR				
A: 18.57		4.68			
DELTA K B:					
MIN C:					
D:					
20.00		4.81			
25.00		13.2			
30.00		24.3			
A: 30.70		30.5			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	12.33

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1585F .75HR AC, 1000F 18,800HRS
FORM: 1.00"TH PLATE   YIELD STRENGTH:
SPECIMEN TYPE: CT   ULT. STRENGTH:
ORIENTATION: SPECIMEN THK: 0.398"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 2.001"
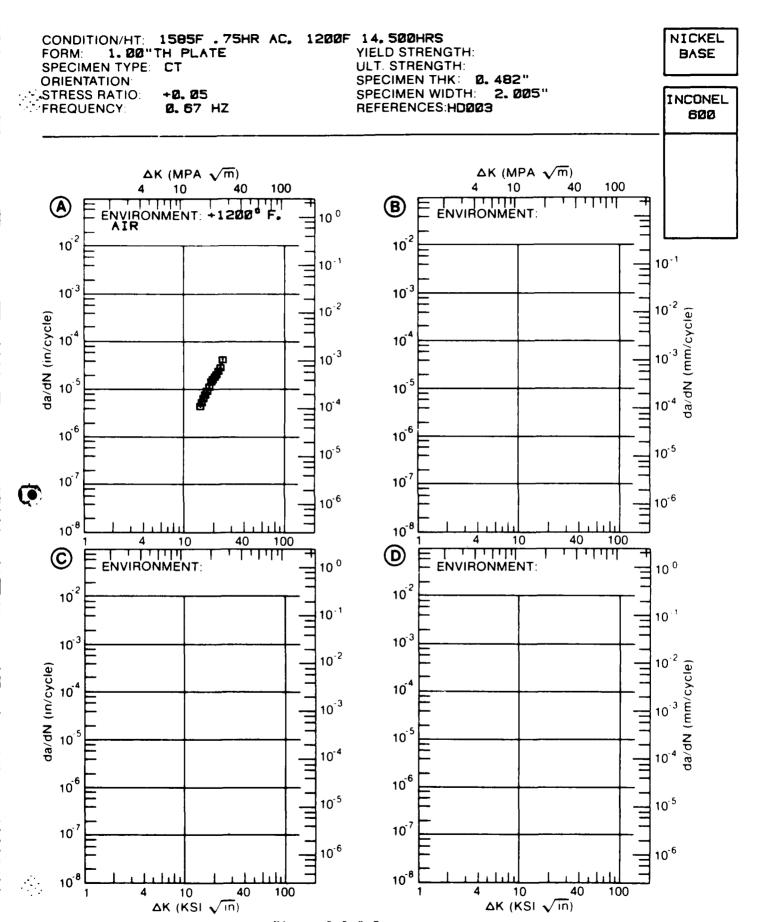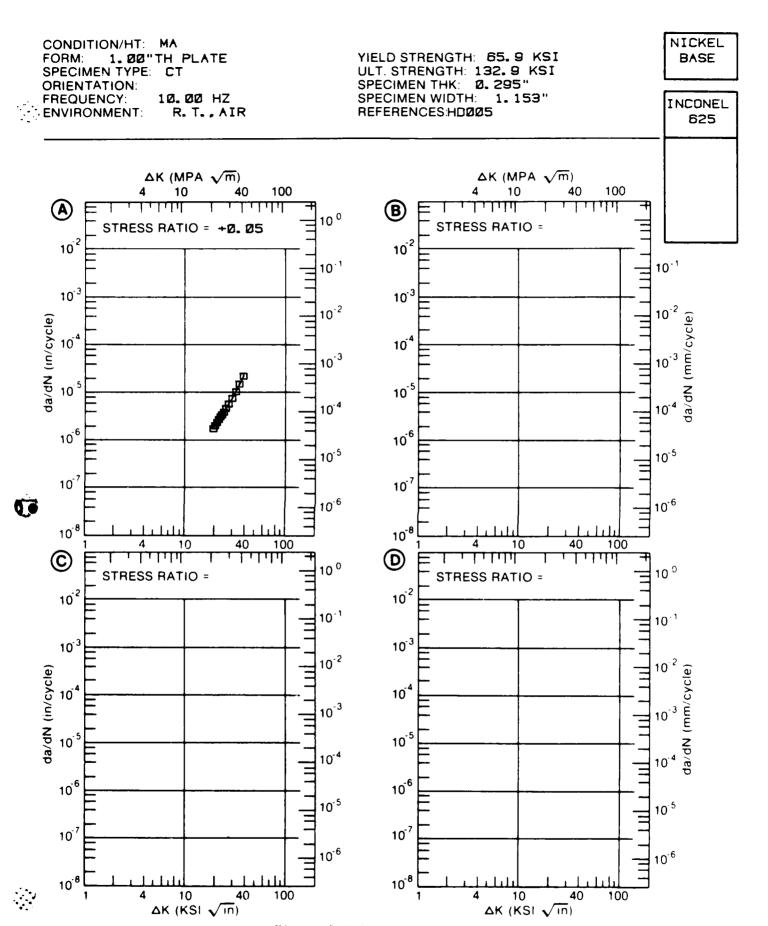FREQUENCY: 0.67 HZ   REFERENCES:HD003

Figure 5.5.3.6

TABLE 5.5.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.5.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   600
CONDITION: 1585F   75HR AC, 1200F 14,500HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F : AIR			
A: 14.24	:	4.17			
DELTA K B:	:				
MIN C:	:				
D:	:				
16.00	:	7.87			
20.00	:	18.3			
A: 23.73	:	37.6			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   5.92
  PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1585F .75HR AC. 1200F 14.500HRS
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.482"
SPECIMEN WIDTH: 2.005"
REFERENCES:HD003

NICKEL BASE

INCONEL 600

A — ENVIRONMENT: +1200° F. AIR
B — ENVIRONMENT:
C — ENVIRONMENT:
D — ENVIRONMENT:

Figure 5.5.3.7

TABLE 5.6.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL 625
CONDITION: MA
ENVIRONMENT: R.T., AIR

DELTA K			DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)			A	B	C	D
			R=+0.05			
A:	18.93		1.71			
DELTA K B:						
MIN C:						
D:						
	20.00		2.07			
	25.00		4.35			
	30.00		8.25			
	35.00		15.4			
A:	37.87		22.2			
DELTA K B:						
MAX C:						
D:						

ROOT MEAN SQUARE   3.21
  PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., AIR

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.295"
SPECIMEN WIDTH: 1.153"
REFERENCES:HD005
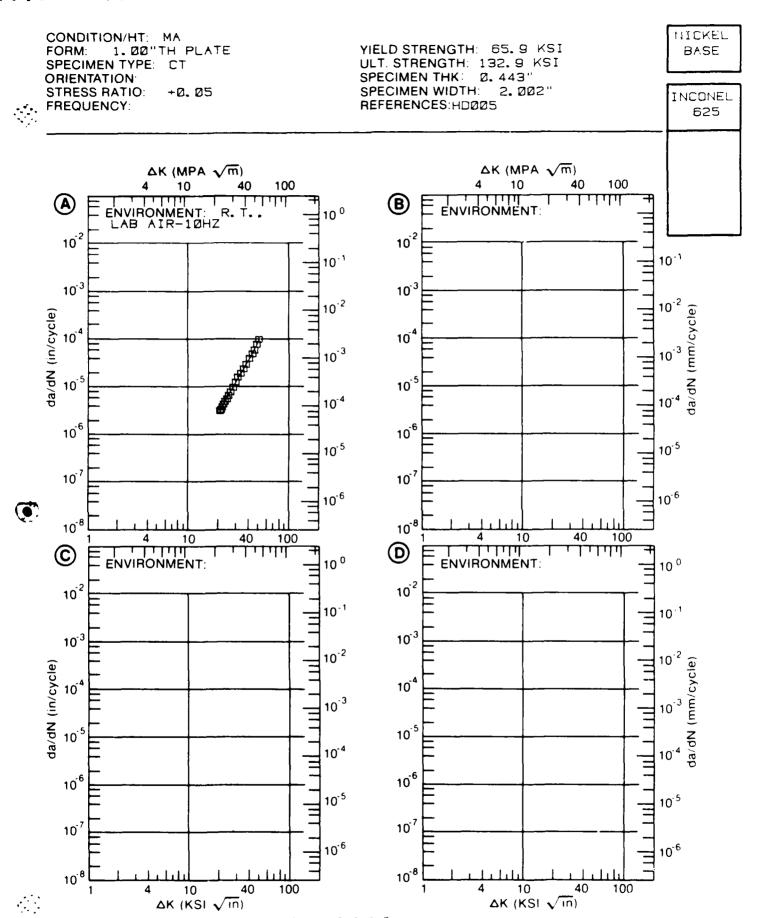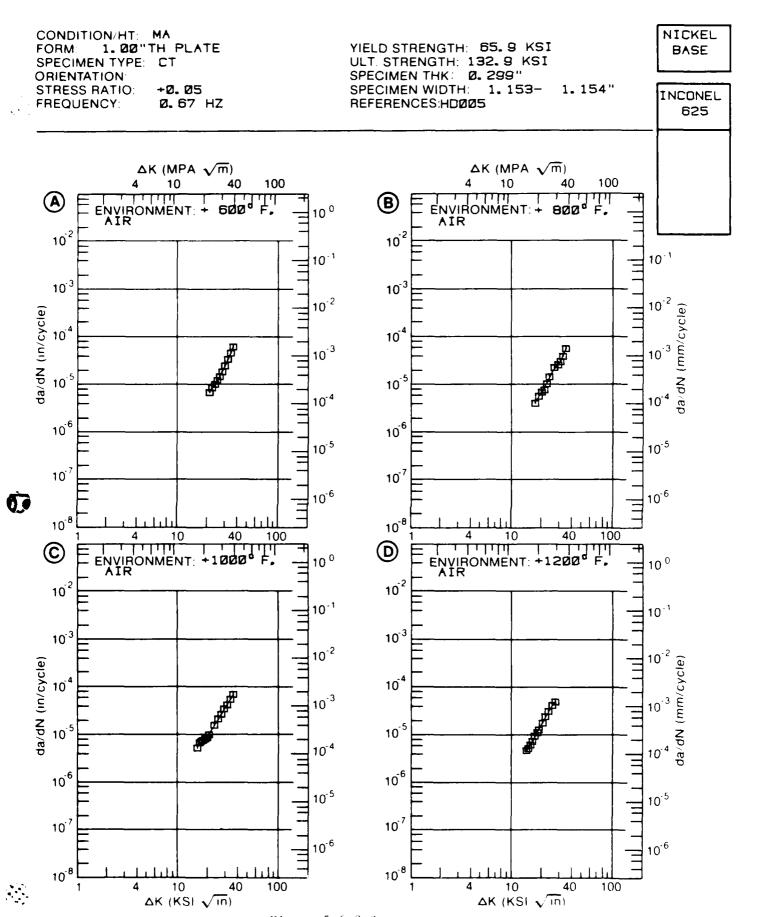
NICKEL
BASE

INCONEL
625

Figure 5.6.3.1

5.6-3

TABLE 5.6.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   625
CONDITION: MA

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R. T. LAB AIR-10HZ			
A: 20.25	:	3.01			
DELTA K B:	:				
MIN C:	:				
D:	:				
25.00	:	7.20			
30.00	:	14.3			
35.00	:	25.1			
40.00	:	40.8			
A: 49.76	:	94.8			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   5.17
 PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.443"
SPECIMEN WIDTH: 2.002"
REFERENCES:HD005

NICKEL
BASE

INCONEL
625

A — ENVIRONMENT: R.T.. LAB AIR—10HZ

B — ENVIRONMENT:

C — ENVIRONMENT:

D — ENVIRONMENT:

ΔK (MPA $\sqrt{m}$)

ΔK (KSI $\sqrt{in}$)

da/dN (in/cycle)

da/dN (mm/cycle)

Figure 5.6.3.2

5.6-5

TABLE 5.6.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   625
CONDITION: MA

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 600F :AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
A:	20.70 :	6.81			
DELTA K B:	16.88 :		4.19		
MIN C:	15.46 :			5.59	
D:	13.75 :				4.52
	16.00 :			5.87	7.50
	20.00 :		7.00	9.68	18.0
	25.00 :	12.5	18.3	20.0	40.3
	30.00 :	26.5	30.3	38.1	
	35.00 :	56.2		62.6	
A:	35.47 :	60.3			
DELTA K B:	34.08 :		55.2		
MAX C:	35.43 :			64.8	
D:	26.80 :				49.1
ROOT MEAN SQUARE PERCENT ERROR		4.72	7.54	5.17	4.35

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.299"
SPECIMEN WIDTH: 1.153– 1.154"
REFERENCES:HD005

NICKEL BASE

INCONEL 625

Figure 5.6.3.3

TABLE 5.6.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.6.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   625
CONDITION: MA

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
DELTA K MIN A: 17.31	1.69			
DELTA K MIN B: 19.54		4.13		
DELTA K MIN C: 17.98			7.23	
DELTA K MIN D: 14.04				6.78
16.00				9.17
20.00	2.98	4.55	9.05	16.5
25.00	7.55	10.7	15.6	30.7
30.00	15.9	21.0	26.9	50.4
35.00	33.6	38.3	46.6	74.1
40.00	63.7	67.0	80.8	
DELTA K MAX A: 46.44	113.			
DELTA K MAX B: 44.02		103.		
DELTA K MAX C: 43.39			117.	
DELTA K MAX D: 38.90				93.8
ROOT MEAN SQUARE PERCENT ERROR	6.43	3.83	3.21	2.39

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	2	1	1	1
1.25-2.0				
>2.0				

CONDITION/HT: MA
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 65.9 KSI
ULT. STRENGTH: 132.9 KSI
SPECIMEN THK: 0.443- 0.445"
SPECIMEN WIDTH: 2.000- 2.002"
REFERENCES:HD005

NICKEL
BASE

INCONEL
625

Figure 5.6.3.4

5.6-9
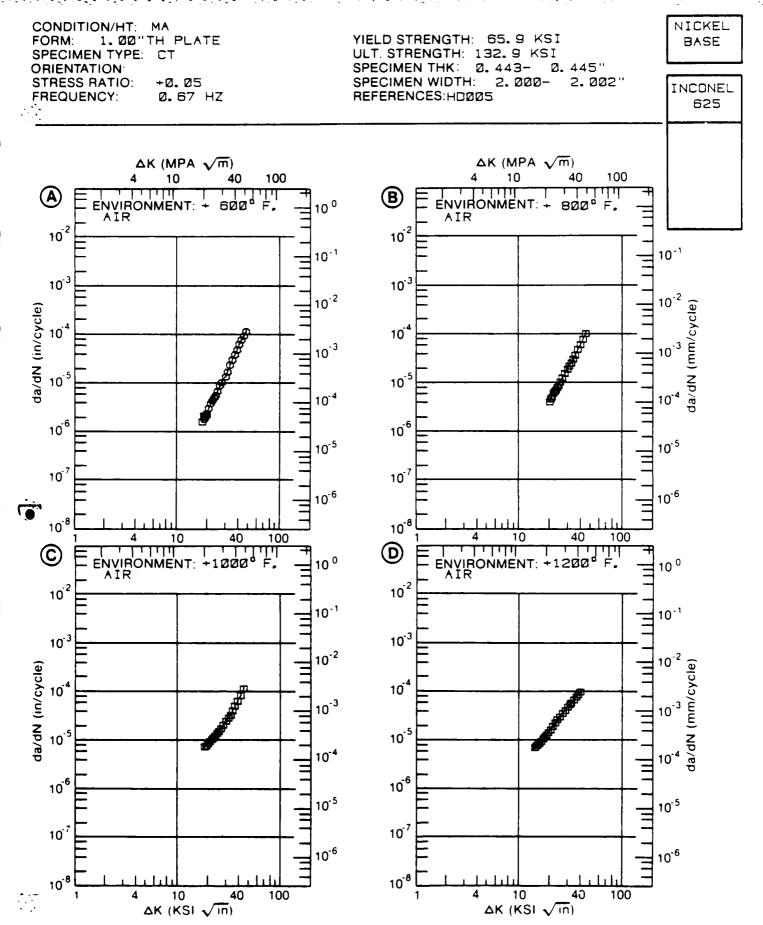
Table 5.7.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 71A

TEST CONDITIONS

SPECIMEN   ENVIRONMENT: LAB AIR
ORIENTATION Unknown   AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN)) 2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F HELD 18HR AC	PLATE	0.05	10.00				1.77	44.1	
1750F AC, 1325F 8HR FC TO 1150F HELD 18HR AC	FORGING	0.05	10.00				1.77	41.7	
1750F 1HR AC, 1325F 8HR FC TO 1150F, HELD 18HR AC(VIM-EFR)	PLATE	0.05	10.00				1.57		

FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)

Table 5.7.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

ENVIRONMENT: AIR AT 600 F

SPECIMEN ORIENTATION Unknown

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))							FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)
				2.5	5	10	20	50	100		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	SHEET	0.05	0.67				1.91	28.4			
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.05	0.67				2.33	58.8			
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	FORGING	0.05	0.67				1.44				
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.05	0.67				1.23				

Table 5.7.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS:

ENVIRONMENT: AIR AT 800 F

SPECIMEN ORIENTATION: Unknown

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	SHEET	0.05	0.67					2.24	30.6	
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	PLATE	0.05	0.67					3.29		
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGING	0.05	0.67					2.05	48.6	

Table 5.7.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

ENVIRONMENT: AIR AT 1000 F

SPECIMEN
ORIENTATION Unknown

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.05	0.06					4.90		
1750F AC, 1325F 2HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.05	0.67					5.01		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.05	6.67					3.23		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.33	6.67					4.06		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	PLATE	0.50	6.67				0.77	6.48		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC	FORGING	0.05	0.67					5.93		

Table 5.7.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN
ORIENTATION   - - -

ENVIRONMENT: AIR
              AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	PLATE	0.05	0.67					17.5		
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGING	0.05	0.67					9.30		

5.7-5

Table 5.7.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN
ORIENTATION: L-T

ENVIRONMENT: L.H.A.
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)							
					2.5	5	10	20	50	100
ST 1850F, 1360F 9HRS, F/C 1175F	FORGED BAR	0.08	6.00						10.0	
ST 1850F, 1360F 9HRS, F/C 1175F	FORGED BAR	0.50	6.00					0.77	30.2	
1325F 8HRS, FC TO 1150F	FORGING	0.08	6.00					1.13	19.0	
1325F 8HRS, FC TO 1150F	FORGING	0.50	6.00					2.17	34.0	

5.7-6

Table 5.7.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT: L.H.A.
AT 400 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
ST 1850F, 1360F 9HRS. F/C 1175F	FORGED BAR	0.08	6.00					13.3	
ST 1850F, 1360F 9HRS. F/C 1175F	FORGED BAR	0.50	6.00				1.66		

Table 5.7.1.8

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS:

SPECIMEN
ORIENTATION: L-T

ENVIRONMENT: LAB AIR
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))			FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	8.33				1.29	30.4	
1950F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	8.33				1.05		

Table 5.7.1.9

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL /18

TEST CONDITIONS

ENVIRONMENT: AIR AT 800 F

SPECIMEN ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))						FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)
				2.5	5	10	20	50	100	
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	0.67				2.93	69.4		
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.05	6.67				1.98			
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.33	6.67				4.40			
1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC	PLATE	0.50	6.67			0.54	5.14			

Table 5.7.1.10

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT: AIR
               AT   1000 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HRS. FC TO 1150F, HELD 18HRS AC	PLATE	0.05	0.67					3.78	63.9	
1750F AC, 1325F 8HRS. FC TO 1150F, HFLD 18HRS AC	PLATE	0.67	6.67				1.18			

5.7-10

Table 5.7.1.11

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL /18

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT: L.H.A. AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
ST 1850F, 1360F 9HRS, F/C 1175F	FORGED BAR	0.08	6.00						16.1	
1325F 8HRS, FC TO 1150F	FORGING	0.08	6.00						32.3	

Table 5.7.1.12

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN
ORIENTATION: C-R

ENVIRONMENT: LAB AIR
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGED BAR	0.05	10.00					2.55	47.2	
1760F 1HR WQ, 1325F 8HRS, FC 1150F 8HRS, AC	DISK	0.00	0.33					2.86		

Table 5.7.1.13

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

ENVIRONMENT: AIR AT 300 F

TEST CONDITIONS

SPECIMEN
ORIENTATION   C-R

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F 1HR 0, 1325F PHR FC TO 1150F AT 100F /HR HOLD 8HR, AC	DISK	-0.33	0.33					0.77		
1750F 1HR 0, 1325F PHR FC TO 1150F AT 100F /HR HOLD 8HR, AC	DISK	0.00	0.33					1.45		
1750F 1HR 0, 1325F 8HR FC TO 1150F AT 100F /HR HOLD 8HR, AC	DISK	0.03	0.33					1.86		
1750F 1HR 0, 1325F PHR FC TO 1150F AT 100F /HR HOLD 8HR, AC	DISK	0.25	0.33					1.09		
1750F 1HR 0, 1325F PHR FC TO 1150F AT 100F /HR HOLD 8HR, AC	DISK	0.54	0.33					3.25		

Table 5.7.1.14

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

ENVIRONMENT: AIR AT 600 F

SPECIMEN
ORIENTATION   C-R

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGED BAR	0.05	0.67					2.32	50.1	
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	-0.33	0.33					2.12		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.00	0.33					1.66		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.25	0.33					2.71		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.54	0.33					3.74		

Table 5.7.1.15

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: C-R ENVIRONMENT: AIR AT 800 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGED BAR	0.05	0.67					2.88		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	-0.33	0.33					2.42	64.2	
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.03	0.33				0.34	2.67		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.25	0.33					2.91		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.54	0.33					5.86		

Table 5.7.1.16

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

ENVIRONMENT: AIR AT 1000 F

TEST CONDITIONS

SPECIMEN ORIENTATION: C-R

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2.5	5	10	20	50	100
				FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC	FORGED BAR	0.05	0.67				7.13	101	
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	-0.33	0.33				3.70		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.00	0.33				3.36		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.03	0.33				2.59		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.03	0.33				4.80		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.25	0.33				6.62		
1750F 1HR Q, 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR, AC	DISK	0.54	0.33			0.85	8.45		

Table 5.7.1.17

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE INCONEL 718

TEST CONDITIONS

SPECIMEN ORIENTATION: C R

ENVIRONMENT: AIR AT 1200 F

CONDITIONS	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) (COMMENTS)	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1750F AC, 1325F 8HR FC TO 1150F, HELD 16HR AC	FORGED BAR	0.05	0.67					21.0		
1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC	DISK	-0.33	0.33					9.75		
1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC	DISK	0.03	0.33					9.92		
1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC	DISK	0.54	0.33				2.12	16.0		
1760F 1HR WQ, 1325F 8HRS. FC TO 1150F 8HRS. AC	DISK	0.00	0.02					8.02	294	
1760F 1HR WQ, 1325F 8HRS. FC TO 1150F 8HRS. AC	DISK	0.00	0.33	SPEC. THK = 0.08"					3.20	60.7
1760F 1HR WQ, 1325F 8HRS. FC TO 1150F 8HRS. AC	DISK	0.00	0.33	SPEC. THK = 0.25"					11.7	110

Table 5.7.2.1

NICKEL BASE   INCONEL 718   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	STAN DEV	DATE	REFER
1325F 8 HR, FC TO 1150F, HOLD 18 HR	F	3.00	R.T.	T-L	160.0	4.022	1.120	CT	1.987	0.53	74.00			1973	88187
1325F 9 HR, FC TO 1150F AT 100F/HR, HOLD AT 1150F 8 HR, AC	F	3.30	R.T.	T-L	151.0	2.002	0.746	CT	1.049	0.68	78.80			1973	88187
1325F 9 HR, FC TO 1150F AT 100F/HR, HOLD AT 1150F 8 HR, AC	F	3.30	R.T.	S-L	143.0	2.002	0.749	CT	1.060	0.53	65.60			1973	88187

Table 5.7.2.2

NICKEL BASE   INCONEL 718   K(C)

BUCKLING OF CRACK EDGES NOT RESTRAINED

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	--SPECIMEN-- WIDTH (IN) W	THICK (IN) B	CRACK LENGTH INIT (IN) 2A(0)	FINAL (IN) 2A(F)	GROSS STRESS MAX (KSI) S(MAX)	ONSET (KSI) S(0)	K(APP) (KSI*SQRT IN)	K(APP) MEAN (KSI*SQRT IN)	K(APP) STAN DEV	K(C) (KSI*SQRT IN)	K(C) MEAN (KSI*SQRT IN)	K(C) STAN DEV	DATE	REFER
COLD ROLLED 30 PERCENT AND AGED	0 03		- 423	L-T	269.0	4.000	0.028	1.370	1.480	112.00	---	177.30			186.79			1964	60578
	0 03				269.0	4.000	0.028	1.280	1.420	117.00	---	177.22			189.70			1964	60578
	0 03				269.0	4.000	0.028	1.740	2.000	90.50	---	169.90			190.76			1964	60578
	0 03				269.0	4.000	0.028	1.310	1.340	116.00	---	178.34			180.98			1964	60578
	0 03				269.0	4.010	0.027	1.270	1.450	116.00	---	174.77			190.67			1964	60578
	0 03				269.0	4.010	0.028	1.740	2.000	87.50	---	164.15			184.25			1964	60578
	0 03				269.0	4.010	0.028	1.770	2.050	91.50	---	173.97			197.02			1964	60578
	0 03				269.0	4.010	0.028	1.240	1.500	119.00	---	176.61			200.22			1964	60578
	0 03				269.0	4.010	0.028	1.730	1.920	89.00	---	166.22			180.87			1964	60578
	0 03				269.0	4.010	0.027	1.240	1.370	117.00	---	173.64			185.14			1964	60578
	0 03				269.0	4.010	0.027	1.250	1.400	120.00	---	178.99			192.64			1964	60578
	0 03				269.0	4.010	0.028	0.750	0.890	168.00	---	186.38			204.90*			1964	60578
	0 03				269.0	4.010	0.028	1.250	1.400	118.00	---	176.01			189.43			1964	60578
	0 03				269.0	4.010	0.028	0.740	0.950	169.00	---	186.13			213.90*			1964	60578
	0 03				269.0	4.010	0.027	1.270	1.400	119.00	---	179.29			191.03			1964	60578
	0 03				269.0	4.010	0.028	0.750	1.020	158.00	---	175.29			208.37			1964	60578
	0 03				269.0	4.020	0.027	1.750	2.050	92.50	---	174.19	175.8/	5.7	198.97	191.1/	7.5	1964	60578
COLD ROLLED 30 PERCENT AGED	0 03		- 320	L-T	259.0	3.980	0.028	1.330	1.550	119.00	---	184.90			205.22			1964	60578
	0 03				259.0	4.000	0.028	0.730	0.830	171.00	---	186.97*			200.60*			1964	60578
	0 03				259.0	4.000	0.028	1.290	1.650	118.00	---	179.63			212.75			1964	60578
	0 03				259.0	4.000	0.028	0.730	0.930	169.00	---	184.78			211.35*			1964	60578
	0 03				259.0	4.000	0.028	1.270	1.650	121.00	---	182.37			218.16			1964	60578
	0 03				259.0	4.010	0.027	1.310	1.620	123.00	---	189.10			218.77			1964	60578
	0 03				259.0	4.010	0.028	1.250	1.400	126.00	---	187.94			202.27			1964	60578
	0 03				259.0	4.010	0.028	1.730	1.920	92.00	---	171.83			186.97			1964	60578
	0 03				259.0	4.010	0.028	1.300	1.750	125.00	---	191.16			235.55*			1964	60578
	0 03				259.0	4.010	0.028	1.250	1.450	119.00	---	177.50			195.61			1964	60578
	0 03				259.0	4.010	0.028	1.730	1.790	89.10	---	166.41			170.92			1964	60578
	0 03				257.0	4.010	0.028	1.720	2.000	90.30	---	167.90			190.15			1964	60578
	0 03				259.0	4.010	0.028	1.730	2.090	91.90	---	171.64			201.46			1964	60578
	0 03				259.0	4.010	0.028	0.740	0.950	177.00	---	194.94*			224.02*			1964	60578
	0 03				259.0	4.010	0.028	0.730	0.850	170.00	---	185.85*			202.06*			1964	60578
	0 03				259.0	4.010	0.028	1.230	1.400	127.00	---	187.53			203.87			1964	60578

*NOTE- NET SECTION STRESS EXCEEDS 80% OF YIELD STRENGTH. VALUE NOT INCLUDED IN MEAN OR STD. DEV

Table 5.7.2.2 (con't)

NICKEL BASE   INCONEL 718   K(C)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	CRACK LENGTH INIT (IN) 2A(O)	CRACK LENGTH FINAL (IN) 2A(F)	GROSS STRESS ONSET (KSI) S(O)	GROSS STRESS MAX (KSI) S(MAX)	K(APP) (KSI*SQRT IN)	K(APP) MEAN	K(APP) STAN DEV	K(C) (KSI*SQRT IN)	K(C) MEAN	K(C) STAN DEV	DATE	REFER
COLD ROLLED 30 PERCENT AND AGED	S	0.03	-320	L-T	259.0	4.010	0.028	1.250	1.450	---	129.00	192.42			212.04			1964	60578
		0.03			259.0	4.010	0.028	1.720	1.950	---	91.90	170.88	180.4	8.8	189.27	200.6	13.8	1964	60578

BUCKLING OF CRACK EDGES NOT RESTRAINED

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	CRACK LENGTH INIT (IN) 2A(O)	CRACK LENGTH FINAL (IN) 2A(F)	GROSS STRESS ONSET (KSI) S(O)	GROSS STRESS MAX (KSI) S(MAX)	K(APP) (KSI*SQRT IN)	K(APP) MEAN	K(APP) STAN DEV	K(C) (KSI*SQRT IN)	K(C) MEAN	K(C) STAN DEV	DATE	REFER
COLD ROLLED 30 PERCENT AND AGED	S	0.03	R T	L-T	218.0	4.000	0.028	1.250	1.550	---	112.00	167.12			192.94*			1964	60578
		0.03			218.0	4.000	0.028	1.730	1.980	---	83.00	155.12			173.40			1964	60578
		0.03			218.0	4.000	0.028	1.230	1.480	---	116.00	171.34			193.46*			1964	60578
		0.03			218.0	4.000	0.028	1.250	1.450	---	111.00	165.62			182.54			1964	60578
		0.03			218.0	4.000	0.028	0.730	1.050	---	138.00	150.89			185.16*			1964	60578
		0.03			218.0	4.000	0.028	1.720	2.100	---	81.80	152.20			180.32			1964	60578
		0.03			218.0	4.010	0.028	0.720	0.890	---	143.00	155.17			174.41*			1964	60578
		0.03			218.0	4.010	0.028	1.720	2.150	---	85.50	158.98			192.56*			1964	60578
		0.03			218.0	4.010	0.028	0.720	0.940	---	145.00	157.34*			182.41*			1964	60578
		0.03			218.0	4.010	0.028	0.740	0.880	---	138.00	151.99			167.24*			1964	60578
		0.03			218.0	4.010	0.028	1.730	2.100	---	80.10	149.60			176.38			1964	60578
		0.03			218.0	4.010	0.028	1.240	1.460	---	110.00	163.25			181.66			1964	60578
		0.03			218.0	4.010	0.028	0.730	1.000	---	148.00	161.80*			192.94*			1964	60578
		0.03			218.0	4.010	0.028	1.720	1.950	---	85.80	159.53			176.70			1964	60578
		0.03			218.0	4.010	0.027	1.280	1.500	---	118.00	178.68			198.54*			1964	60578
		0.03			218.0	4.010	0.028	1.320	1.650	---	104.00	160.62			187.39*			1964	60578
		0.03			218.0	4.010	0.028	1.240	1.550	---	112.00	166.22			192.84*			1964	60578
		0.03			218.0	4.020	0.028	1.270	1.730	---	108.00	162.67			201.57*			1964	60578
		0.03			218.0	4.020	0.026	1.310	1.700	---	114.00	175.14	161.4	8.6	209.94*	178.5	3.6	1964	60578
COLD ROLLED 30 PERCENT AND AGED	S	0.03	R.T.	L-T	218.0	17.930	0.026	5.480	5.880	---	64.40	200.63			233.26			1964	60578
		0.03			218.0	17.930	0.026	5.480	5.880	---	64.30	200.31			209.48			1964	60578
		0.03			218.0	17.940	0.026	5.470	6.820	---	65.50	203.81			235.75			1964	60578
		0.03			218.0	18.080	0.026	5.480	6.680	---	61.30	170.77			217.14			1964	60578
		0.03			218.0	18.080	0.026	5.470	7.200	---	60.90	189.31	197.0	6.5	227.47	224.6	11.1	1964	60578

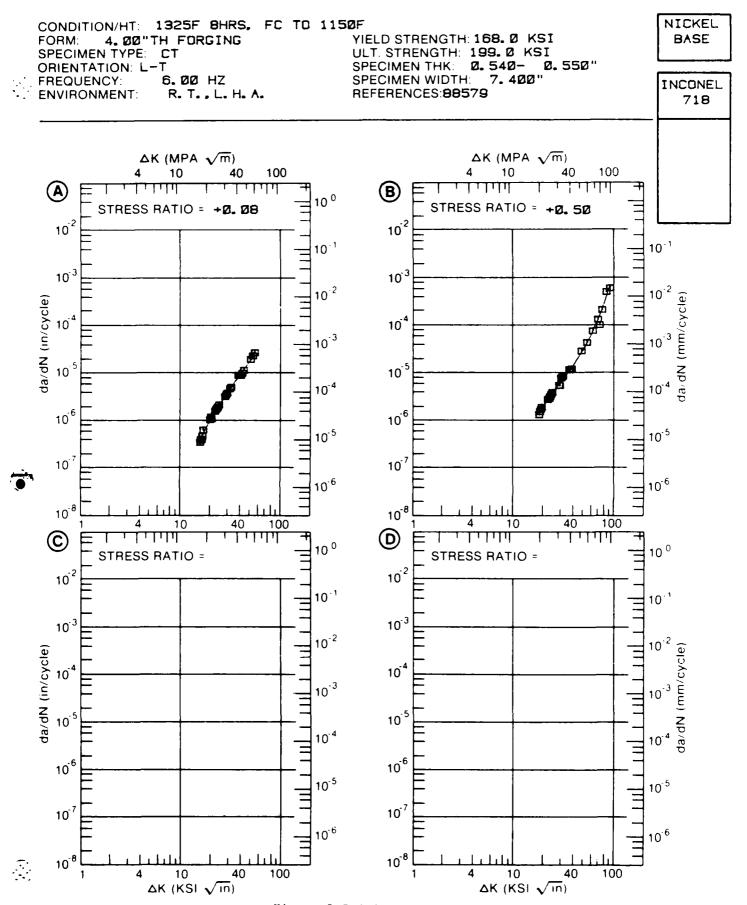*NOTE- NET SECTION STRESS EXCEEDS 80% OF YIELD STRENGTH. VALUE NOT INCLUDED IN MEAN OR STD. DEV

TABLE 5.7.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1325F 8HRS, FC TO 1150F
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.08	R=+0.50		
DELTA K MIN A:	15.35	.300			
DELTA K MIN B:	17.63		1.40		
DELTA K MIN C:					
DELTA K MIN D:					
	16.00	.462			
	20.00	1.13	2.17		
	25.00	2.31	4.27		
	30.00	4.22	7.07		
	35.00	6.76	10.9		
	40.00	9.68	16.1		
	50.00	19.0	34.0		
	60.00		71.4		
	70.00		152.		
	80.00		329.		
DELTA K MAX A:	54.42	27.2			
DELTA K MAX B:	89.46		689.		
DELTA K MAX C:					
DELTA K MAX D:					

ROOT MEAN SQUARE PERCENT ERROR	6.41	11.84		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1325F 8HRS. FC TO 1150F
FORM: 4.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 168.0 KSI
ULT. STRENGTH: 199.0 KSI
SPECIMEN THK: 0.540- 0.550"
SPECIMEN WIDTH: 7.400"
REFERENCES: 88579

NICKEL
BASE

INCONEL
718

Figure 5.7.3.1

5.7-23

TABLE 5.7.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE   INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1325F 8HRS, FC TO 1150F
ENVIRONMENT: R.T. ,L.H.A.

DELTA K	:	DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)	:				
	:	A	B	C	D
	:	R=+0.08			
A: 21.31	:	1.56			
DELTA K B:	:				
MIN C:	:				
D:	:				
25.00	:	2.77			
30.00	:	5.09			
35.00	:	8.68			
40.00	:	14.3			
50.00	:	32.3			
60.00	:	59.0			
70.00	:	107.			
80.00	:	284.			
A: 86.24	:	790.			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE	8.94
PERCENT ERROR	

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1325F 8HRS. FC TO 1150F
FORM: 4.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T.,L.H.A.

YIELD STRENGTH:166.0 KSI
ULT. STRENGTH: 197.0 KSI
SPECIMEN THK: 0.510"
SPECIMEN WIDTH: 6.010"
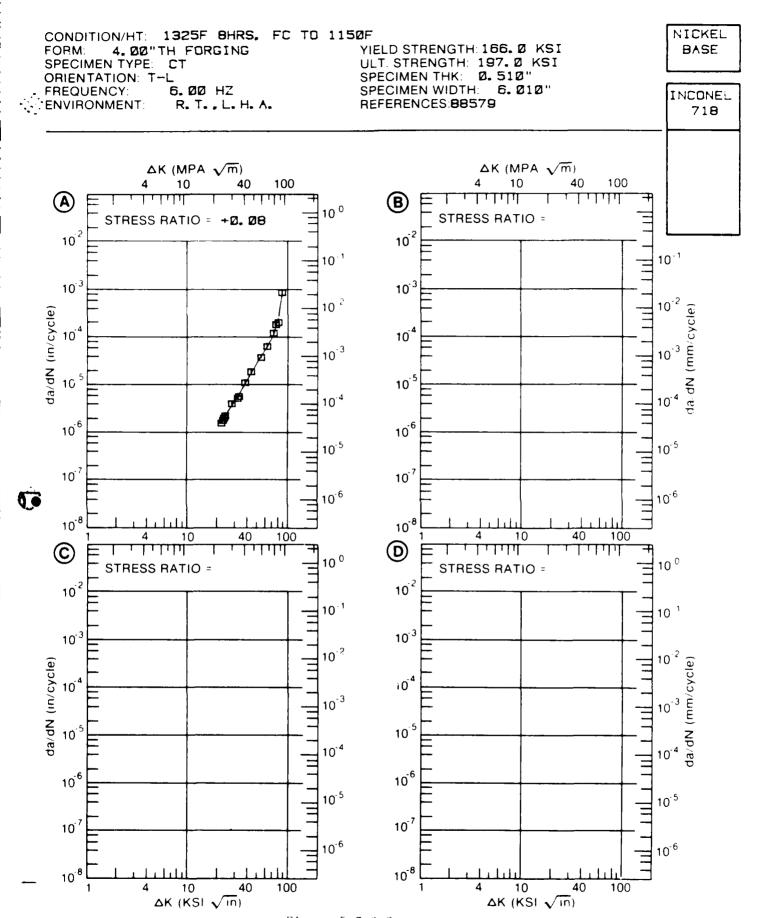REFERENCES:88579

NICKEL
BASE

INCONEL
718

Figure 5.7.3.2

TABLE 5.7.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. AIR			
A: 14.22		.612			
DELTA K B:					
MIN C:					
D:					
16.00		.975			
20.00		1.96			
25.00		3.39			
30.00		5.13			
35.00		7.46			
40.00		10.8			
A: 47.95		20.1			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	3.66

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.06"TH SHEET   YIELD STRENGTH: 174.0 KSI
SPECIMEN TYPE: CCP   ULT. STRENGTH: 204.1 KSI
ORIENTATION: SPECIMEN THK: 0.061"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.994"
FREQUENCY: 5.00 HZ   REFERENCES: HD017
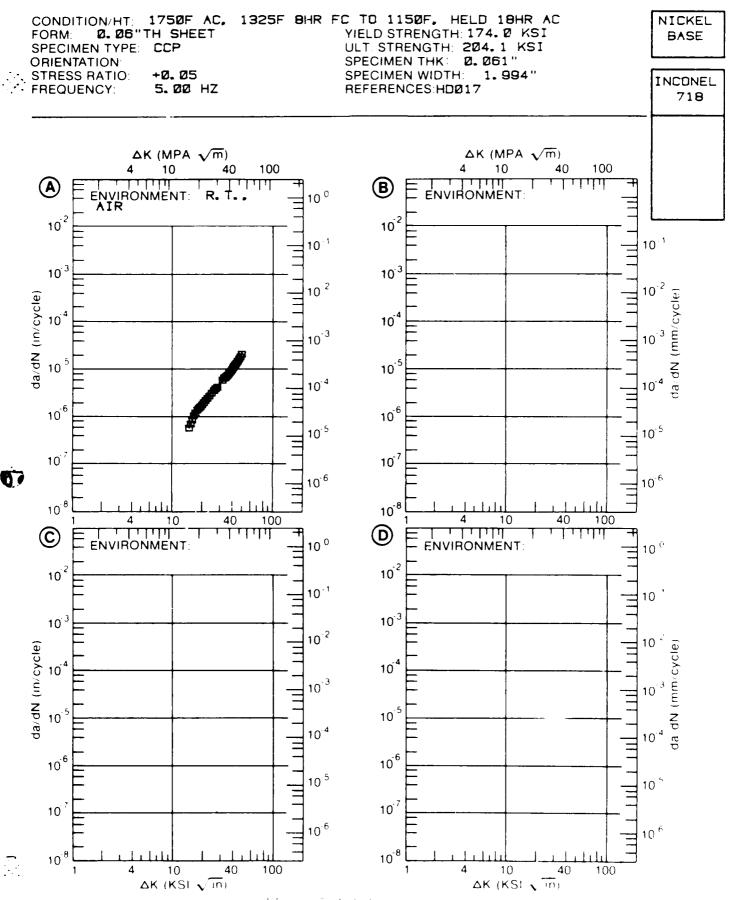
NICKEL BASE

INCONEL 718

Figure 5.7.3.3

5.7-27

TABLE 5.7.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	
DELTA K MIN	A:	18.40	1.51			
	B:	19.39		2.06		
	C:	23.42			10.8	
	D:					
		20.00	1.91	2.24		
		25.00	3.50	3.95	12.3	
		30.00	5.72	6.35	17.9	
		35.00	8.86	9.71	23.7	
		40.00	13.3	14.4	28.4	
		50.00	28.4	30.6		
DELTA K MAX	A:	57.54	49.4			
	B:	57.84		53.8		
	C:	40.06			28.5	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			3.58	4.18	3.30	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.06"TH SHEET
SPECIMEN TYPE: CCP
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 174.0 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.061"
SPECIMEN WIDTH: 1.995- 2.000"
REFERENCES: HD017

(A) ENVIRONMENT: + 600° F, AIR

(B) ENVIRONMENT: + 800° F, AIR

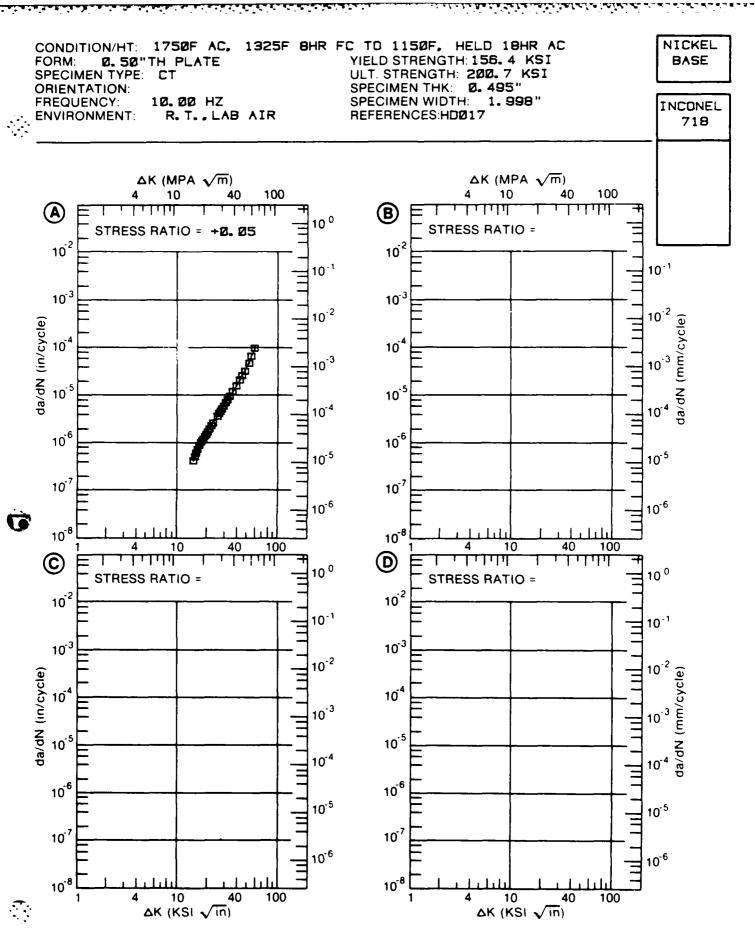(C) ENVIRONMENT: +1000° F, AIR

(D) ENVIRONMENT:

Figure 3.7.1.

TABLE 5.7.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

ENVIRONMENT: R.T., LAB AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.05			
DELTA K MIN	A:	14.19	.438			
	B:					
	C:					
	D:					
		16.00	.754			
		20.00	1.77			
		25.00	3.72			
		30.00	6.69			
		35.00	11.2			
		40.00	18.0			
		50.00	44.1			
DELTA K MAX	A:	58.21	89.9			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	4.88

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.50"TH PLATE   YIELD STRENGTH: 156.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 200.7 KSI
ORIENTATION: SPECIMEN THK: 0.495"
FREQUENCY: 10.00 HZ   SPECIMEN WIDTH: 1.998"
ENVIRONMENT: R.T.,LAB AIR REFERENCES: HD017
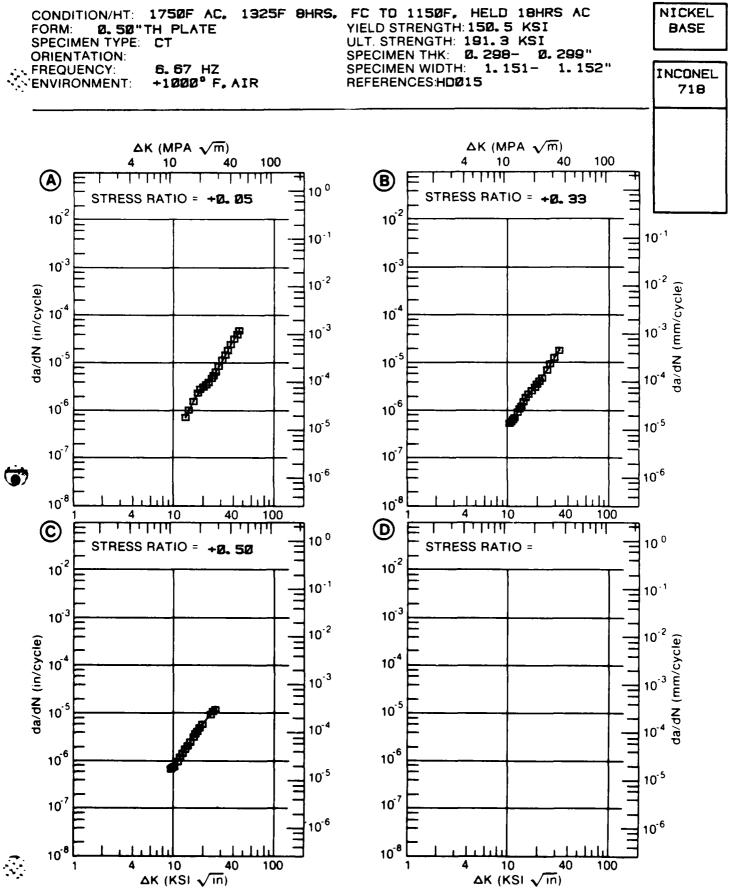
NICKEL
BASE

INCONEL
718

Figure 5.7.3.5

TABLE 5.7.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.6 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.05	R=+0.33	R=+0.50	
	A:	12.91	.693			
DELTA K	B:	10.17		.471		
MIN	C:	9.19			.615	
	D:					
		10.00			.770	
		13.00	.717	1.16	1.72	
		16.00	1.77	2.17	3.38	
		20.00	3.23	4.06	6.48	
		25.00	5.55	7.91	10.9	
		30.00	10.6	14.9		
		35.00	20.1			
		40.00	32.9			
	A:	44.45	43.3			
DELTA K	B:	31.81		18.8		
MAX	C:	25.68			11.7	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			4.84	6.03	4.04	

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC
FORM: 0.50"TH PLATE   YIELD STRENGTH:150.5 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 191.3 KSI
ORIENTATION: SPECIMEN THK: 0.298- 0.299"
FREQUENCY: 6.67 HZ   SPECIMEN WIDTH: 1.151- 1.152"
ENVIRONMENT: +1000° F. AIR   REFERENCES:HD015

NICKEL
BASE

INCONEL
718

Figure 5.7.3.6

TABLE 5.7.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325F   8HRS, FC TO 1150F, HELD 18HRS, AC

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)		A	B	C	D
		E=+ 600F	E=+1000F	E=+1000F	
		AIR, .67HZ	AIR, .001HZ	AIR, .06HZ	
DELTA K MIN	A: 14.29	.386			
	B:				
	C: 15.63			2.11	
	D:				
	16.00	.549		2.27	
	20.00	1.23		4.90	
	25.00	3.03		10.3	
	30.00	6.43		17.2	
	35.00	11.9			
DELTA K MAX	A: 39.08	18.0			
	B:				
	C: 34.70			23.2	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	5.47	0.00	3.25	

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
0.0-0.5			
0.5-0.8			
0.8-1.25	1		1
1.25-2.0			
>2.0			

CONDITION/HT: 1750F AC. 1325F 8HRS. FC TO 1150F, HELD 18HRS. AC
FORM: 0.50"TH PLATE   YIELD STRENGTH: 150.5 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 191.3 KSI
ORIENTATION: SPECIMEN THK: 0.299- 0.300"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.151- 1.152"
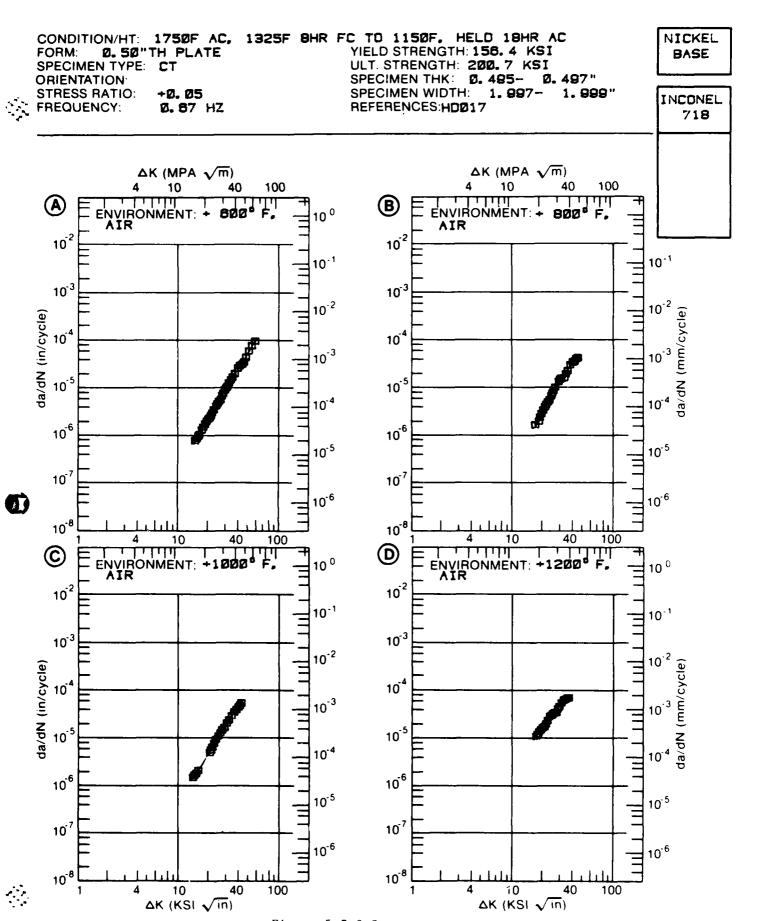FREQUENCY: REFERENCES: HD015

Figure 5.7.3.7

5.7-35

TABLE 5.7.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD
           18HR AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
A:	14.43	.743			
DELTA K B:	16.56		1.49		
MIN C:	13.60			1.44	
D:	16.93				11.1
	16.00	1.06		2.33	
	20.00	2.33	3.29	5.01	17.5
	25.00	5.18	7.87	11.2	32.8
	30.00	9.97	15.0	20.9	52.4
	35.00	17.3	24.2	33.5	73.1
	40.00	27.6	34.7	47.0	
	50.00	58.8			
A:	57.98	95.2			
DELTA K B:	44.06		43.5		
MAX C:	41.58			51.1	
D:	35.62				75.6

ROOT MEAN SQUARE PERCENT ERROR		5.71	7.22	2.95	4.81

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 156.4 KSI
ULT. STRENGTH: 200.7 KSI
SPECIMEN THK: 0.485- 0.497"
SPECIMEN WIDTH: 1.997- 1.999"
REFERENCES: HD017
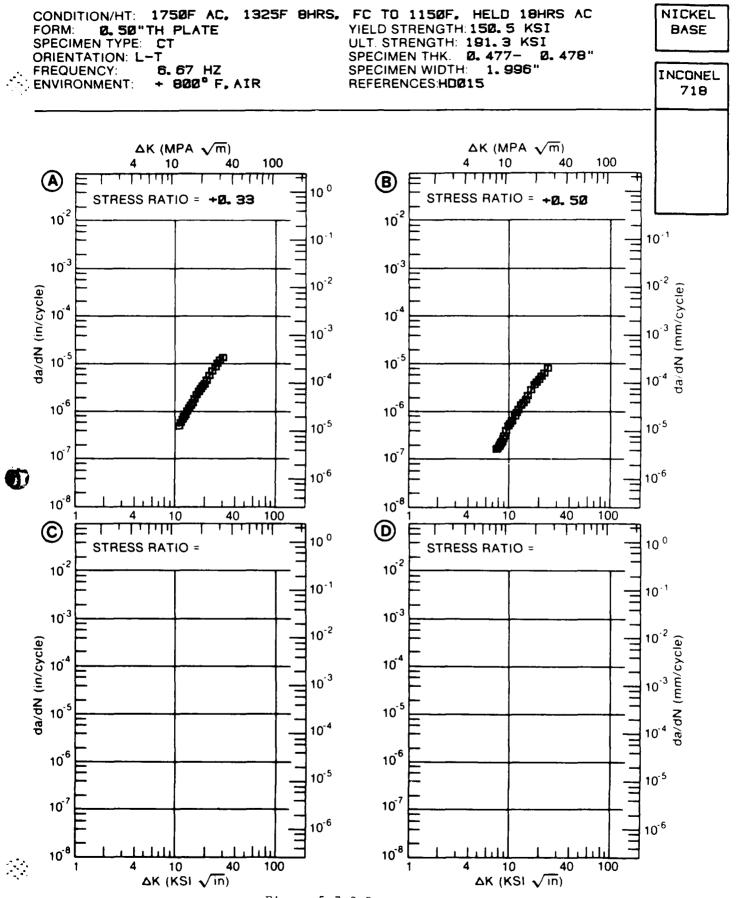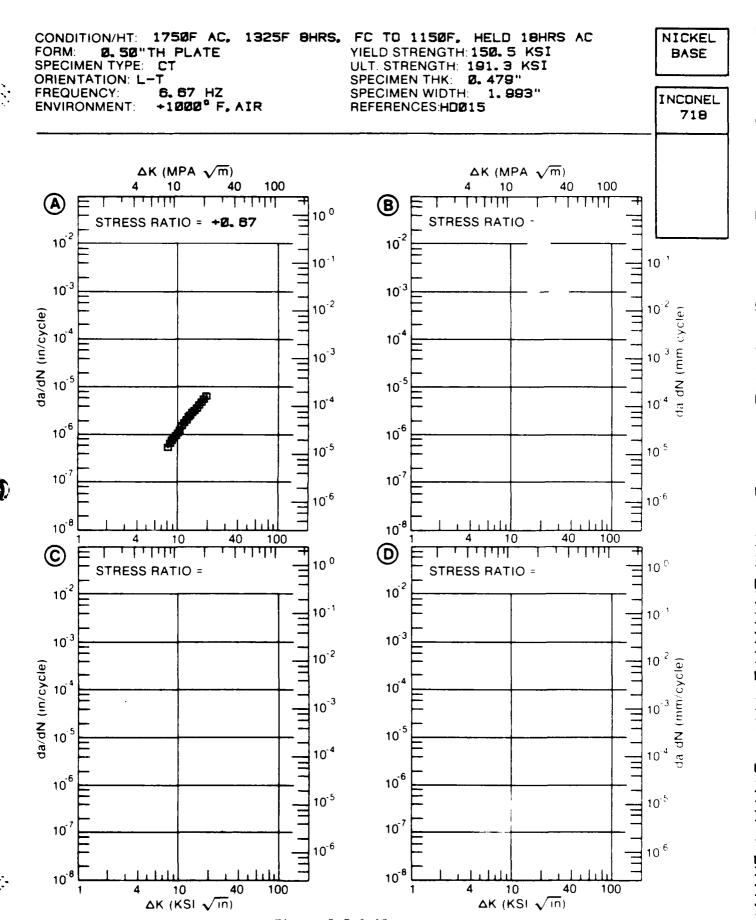
NICKEL
BASE

INCONEL
718

Figure 5.7.3.8

5.7-37

TABLE 5.7.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.9 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.33	R=+0.50		
DELTA K MIN	A: 10.68	.499			
	B: 7.32		.147		
	C:				
	D:				
	8.00		.220		
	9.00		.362		
	10.00		.548		
	13.00	1.00	1.39		
	16.00	2.08	2.68		
	20.00	4.40	5.14		
	25.00	8.86			
DELTA K MAX	A: 29.34	14.1			
	B: 23.56		8.10		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		3.82	5.67		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC

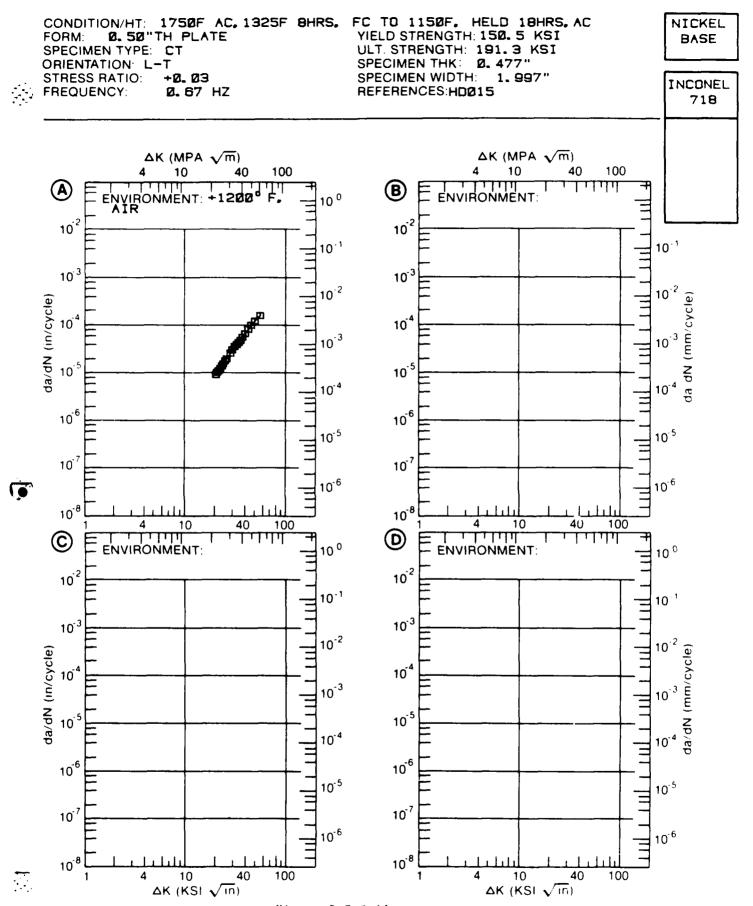|	
FORM: 0.50"TH PLATE	YIELD STRENGTH: 150.5 KSI
SPECIMEN TYPE: CT	ULT. STRENGTH: 191.3 KSI
ORIENTATION: L-T	SPECIMEN THK. 0.477- 0.478"
FREQUENCY: 6.67 HZ	SPECIMEN WIDTH: 1.996"
ENVIRONMENT: + 800° F, AIR	REFERENCES: HD015

NICKEL
BASE

INCONEL
718

Figure 5.7.3.9

TABLE 5.7.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.10 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.67			
DELTA K MIN	A:	7.74 :	.523			
	B:	:				
	C:	:				
	D:	:				
		8.00 :	.585			
		9.00 :	.855			
		10.00 :	1.18			
		13.00 :	2.42			
		16.00 :	4.08			
DELTA K MAX	A:	18.84 :	6.03			
	B:	:				
	C:	:				
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	2.72

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC

FORM: 0.50"TH PLATE YIELD STRENGTH:150.5 KSI

SPECIMEN TYPE: CT ULT. STRENGTH: 191.3 KSI

ORIENTATION: L-T SPECIMEN THK: 0.479"

FREQUENCY: 6.67 HZ SPECIMEN WIDTH: 1.993"

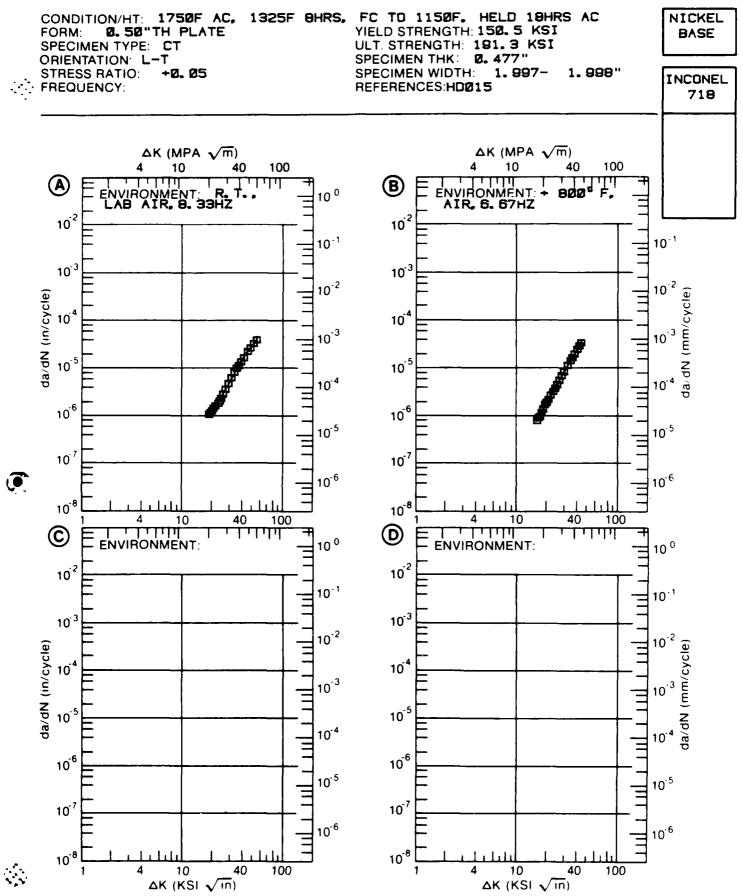ENVIRONMENT: +1000° F, AIR REFERENCES:HD015

Figure 5.7.3.10

TABLE 5.7.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC,1325F 8HRS, FC TO 1150F, HELD 18HRS,AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F AIR			
DELTA K MIN	A: 20.23	9.05			
	B:				
	C:				
	D:				
	25.00	17.8			
	30.00	31.1			
	35.00	48.8			
	40.00	70.7			
	50.00	125.			
DELTA K MAX	A: 55.76	160.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	2.88

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS, AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.03
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 150.5 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.477"
SPECIMEN WIDTH: 1.997"
REFERENCES: HD015

NICKEL BASE

INCONEL 718

Figure 5.7.3.11

5.7-43

TABLE 5.7.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.12 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)		A	B	C	D
		E= R.T.	E=+ 800F		
		LAB AIR, 8.33HZ	AIR, 6.67HZ		
DELTA K MIN	A: 18.26	1.01			
	B: 15.64		.749		
	C:				
	D:				
	16.00		.820		
	20.00	1.29	1.98		
	25.00	2.73	4.69		
	30.00	5.50	9.30		
	35.00	9.95	16.3		
	40.00	16.0	25.9		
	50.00	30.4			
DELTA K MAX	A: 54.46	35.9			
	B: 42.78		32.5		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		5.56	4.55		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC, 1325F 8HRS, FC TO 1150F, HELD 18HRS AC
FORM: 0.50"TH PLATE   YIELD STRENGTH: 150.5 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 191.3 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.477"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.997- 1.998"
FREQUENCY: REFERENCES:HD015
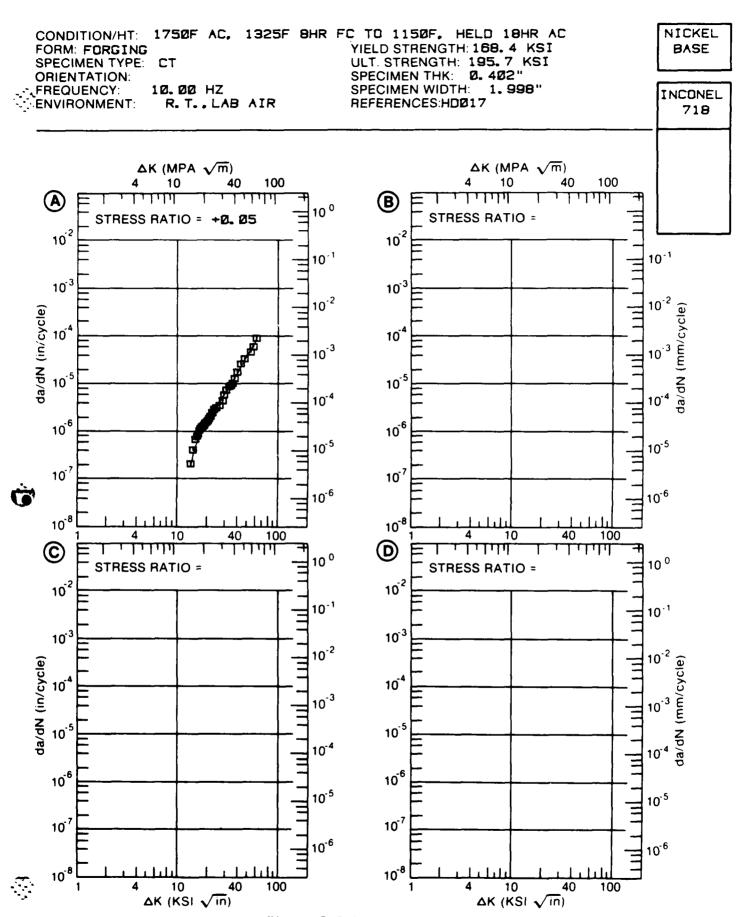
NICKEL
BASE

INCONEL
718

Figure 5.7.3.12

5.7-45

TABLE 5.7.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.13 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL 718
CONDITION: 1750F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 800F : AIR	E=+1000F AIR		
DELTA K MIN A:	16.57 :	1.25			
B:	15.20 :		1.43		
C:	:				
D:	:				
	16.00 :		1.73		
	20.00 :	2.93	3.78		
	25.00 :	6.96	7.63		
	30.00 :	13.1	13.2		
	35.00 :	21.6	20.8		
	40.00 :	33.1	31.1		
	50.00 :	69.4	63.9		
	60.00 :		122.		
DELTA K MAX A:	56.07 :	104.			
B:	66.35 :		181.		
C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	5.56	12.07

LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	5
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

CONDITION/HT: 1750F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 129.0- 150.5 KSI
ULT. STRENGTH: 160.1- 191.3 KSI
SPECIMEN THK: 0.476- 0.478"
SPECIMEN WIDTH: 1.996- 1.998"
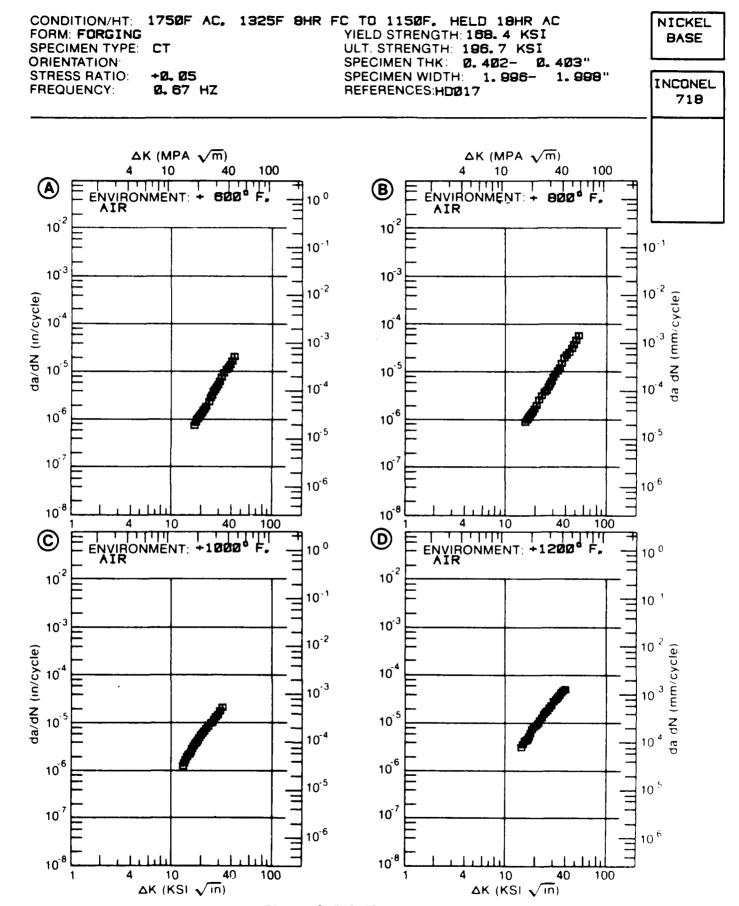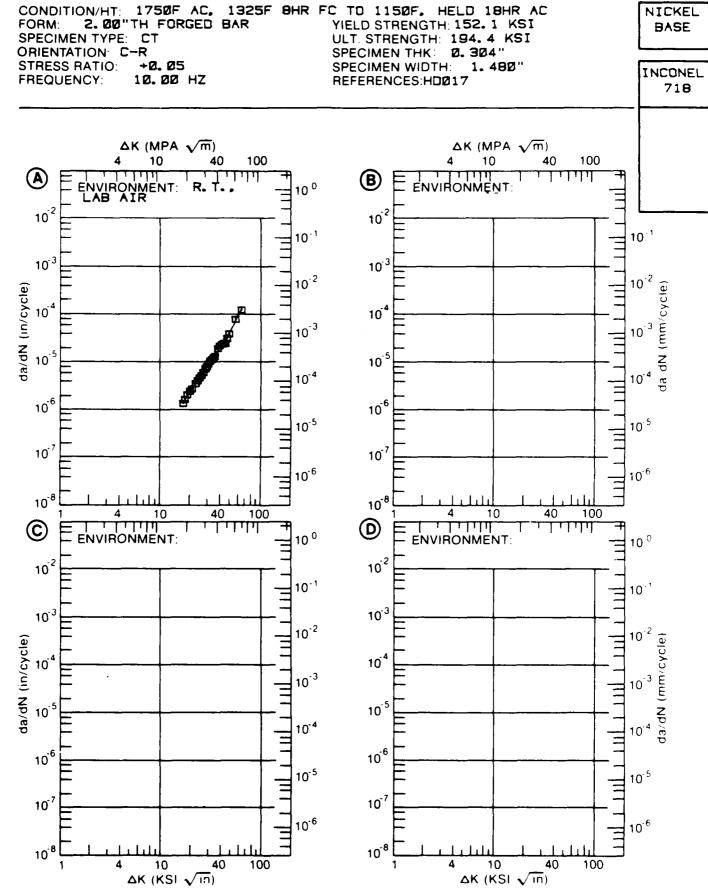REFERENCES: HD015

NICKEL
BASE

INCONEL
718

Figure 5.7.3.13

TABLE 5.7.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.14 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

ENVIRONMENT: R.T., LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05			
DELTA K MIN	A: 13.06	.190			
	B:				
	C:				
	D:				
	16.00	.871			
	20.00	1.77			
	25.00	3.70			
	30.00	6.86			
	35.00	11.7			
	40.00	18.7			
	50.00	41.7			
DELTA K MAX	A: 59.94	80.8			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	9.07

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: FORGING   YIELD STRENGTH: 168.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 195.7 KSI
ORIENTATION: SPECIMEN THK: 0.402"
FREQUENCY: 10.00 HZ   SPECIMEN WIDTH: 1.998"
ENVIRONMENT: R.T., LAB AIR   REFERENCES: HD017

NICKEL
BASE

INCONEL
718

Figure 5.7.3.14

TABLE 5.7.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.15 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
A:	16.43	.786			
DELTA K B:	15.22		.849		
MIN C:	12.64			1.22	
D:	14.06				3.09
	13.00			1.38	
	16.00		.993	3.06	4.71
	20.00	1.44	2.05	5.93	9.30
	25.00	3.28	4.40	10.7	17.4
	30.00	6.61	8.32	17.9	28.2
	35.00	11.5	14.3		41.7
	40.00	17.4	22.7		
	50.00		48.6		
A:	41.28	19.0			
DELTA K B:	51.90		54.9		
MAX C:	31.19			20.2	
D:	38.42				52.5
ROOT MEAN SQUARE PERCENT ERROR		4.75	5.36	3.25	4.14

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: FORGING
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 168.4 KSI
ULT. STRENGTH: 196.7 KSI
SPECIMEN THK: 0.402- 0.403"
SPECIMEN WIDTH: 1.996- 1.998"
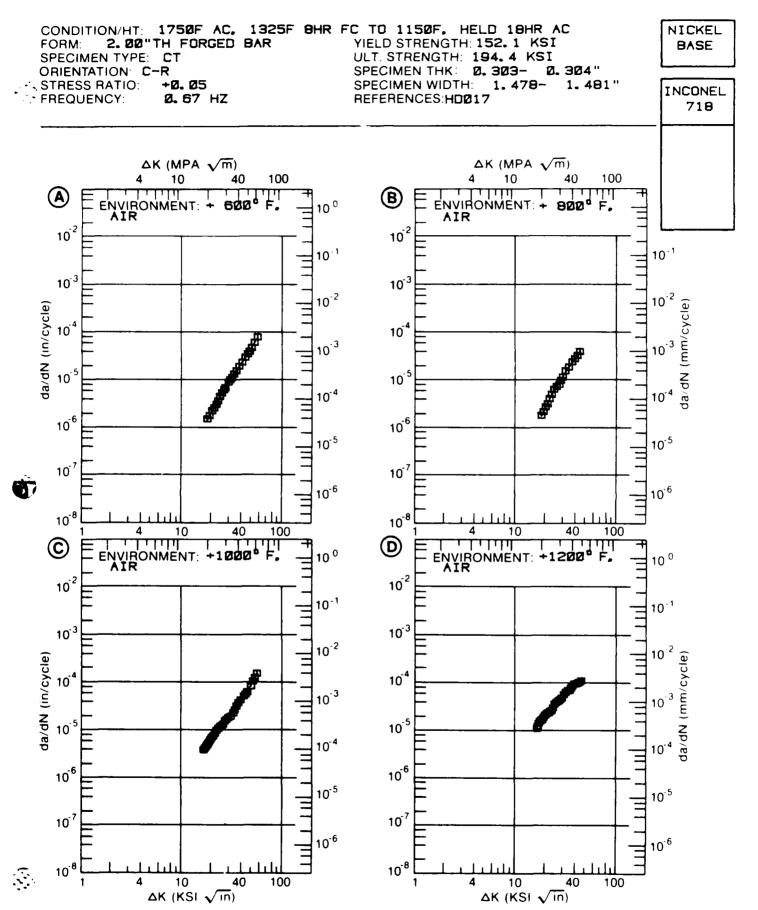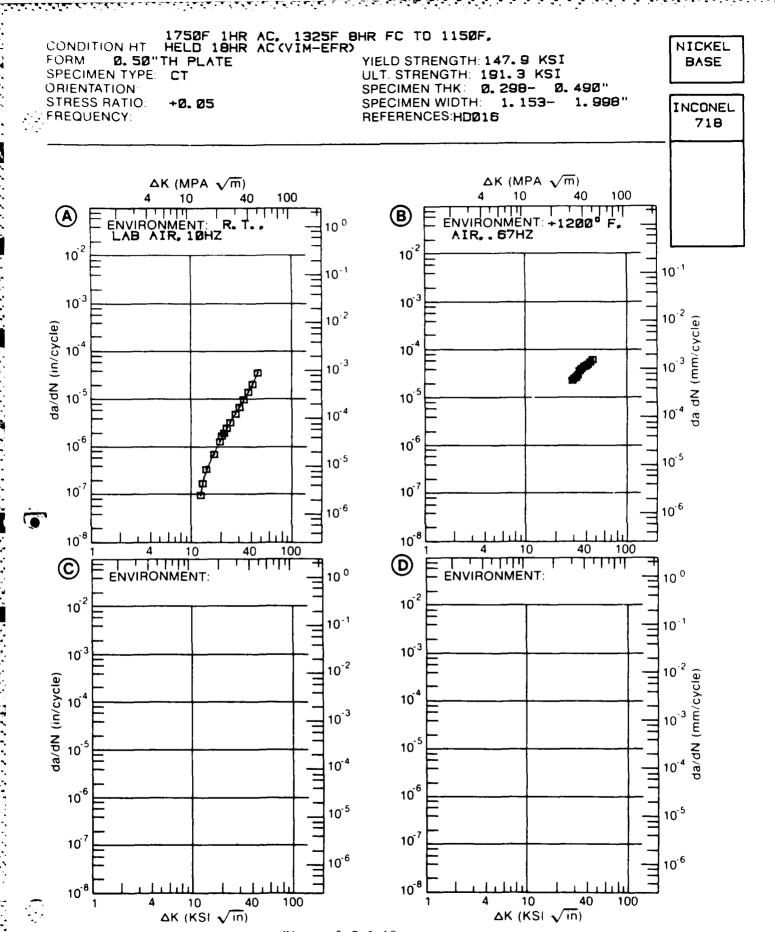REFERENCES: HD017

NICKEL
BASE

INCONEL
718

Figure 5.7.3.15

TABLE 5.7.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325 F 8HR FC TO 1150F, HELD 18HR AC

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	E= R.T. LAB AIR			
DELTA K MIN A: 16.57	1.36			
DELTA K MIN B:				
DELTA K MIN C:				
DELTA K MIN D:				
20.00	2.55			
25.00	5.07			
30.00	8.74			
35.00	14.0			
40.00	21.5			
50.00	47.2			
60.00	98.4			
DELTA K MAX A: 63.69	128.			
DELTA K MAX B:				
DELTA K MAX C:				
DELTA K MAX D:				

ROOT MEAN SQUARE PERCENT ERROR	7.64

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1750F AC. 1325F 8HR FC TO 1150F. HELD 18HR AC
FORM: 2.00"TH FORGED BAR   YIELD STRENGTH: 152.1 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 194.4 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.304"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.480"
FREQUENCY: 10.00 HZ   REFERENCES:HD017
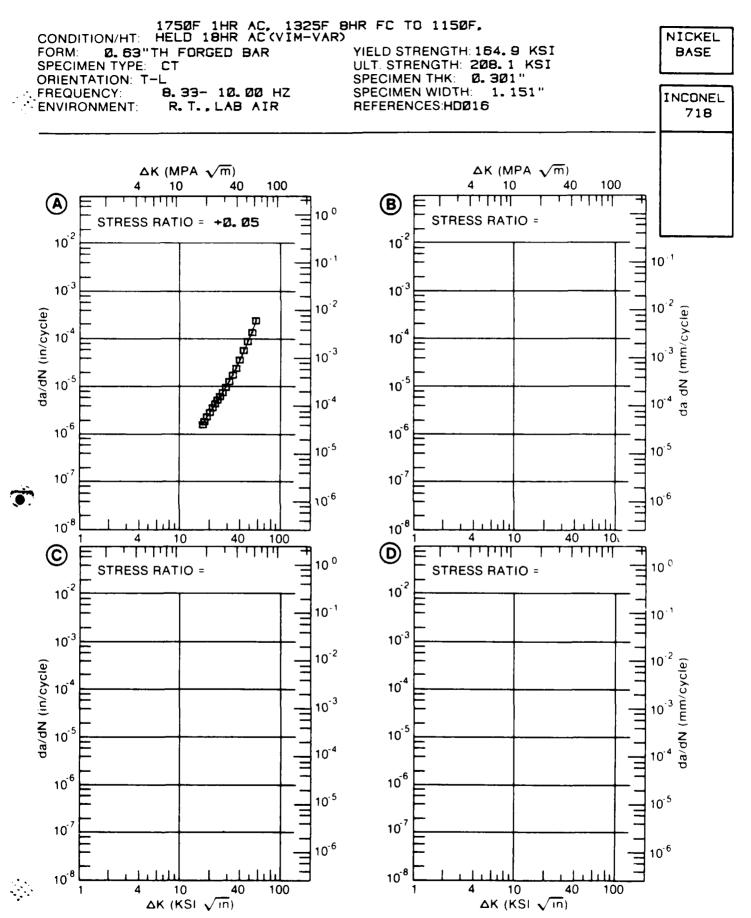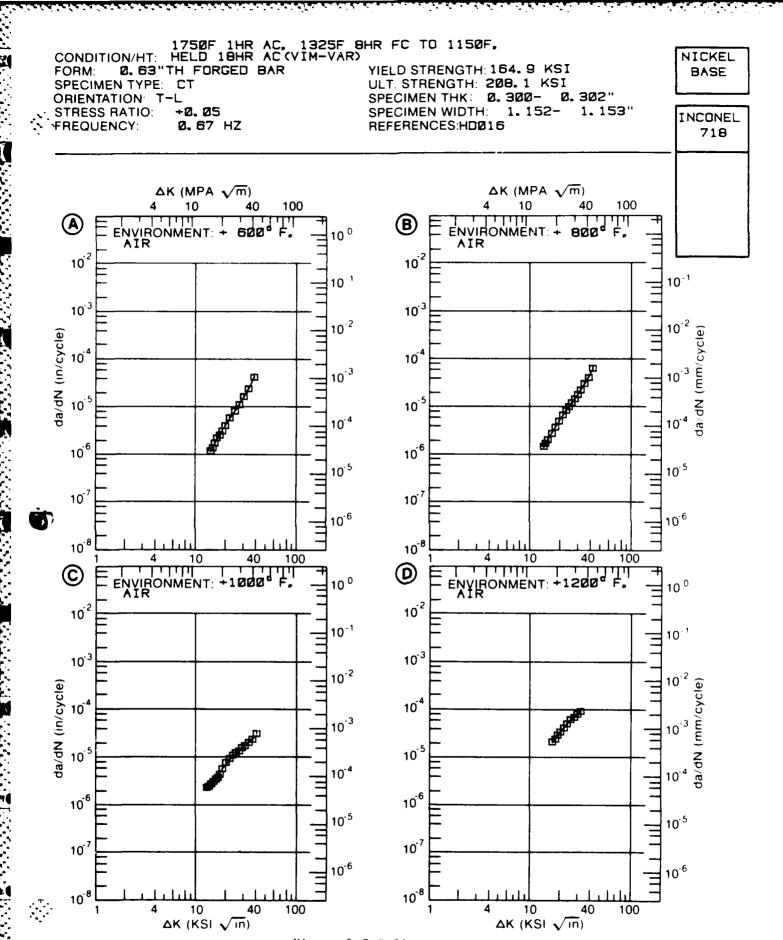
NICKEL
BASE

INCONEL
718

Figure 5.7.3.16

5.7-53

TABLE 5.7.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 600F :AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
A:	17.61	1.38			
DELTA K B:	17.80		1.72		
MIN C:	16.17			3.68	
D:	16.10				12.5
	20.00	2.32	2.88	7.13	21.0
	25.00	5.29	6.91	12.9	36.4
	30.00	9.77	12.9	20.5	55.6
	35.00	16.0	21.0	31.0	76.1
	40.00	24.4	31.2	45.9	95.3
	50.00	50.1		101.	
A:	56.32	74.9			
DELTA K B:	42.93		38.3		
MAX C:	55.00			150.	
D:	44.50				110.
ROOT MEAN SQUARE PERCENT ERROR		4.54	5.17	4.81	4.86

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1750F AC, 1325F 8HR FC TO 1150F, HELD 18HR AC
FORM: 2.00"TH FORGED BAR   YIELD STRENGTH: 152.1 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 194.4 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.303- 0.304"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.478- 1.481"
FREQUENCY: 0.67 HZ   REFERENCES:HD017

| NICKEL BASE |
| INCONEL 718 |

Figure 5.7.3.17

5.7-55

TABLE 5.7.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR AC, 1325F 8HR FC TO 1150F,
         HELD 18HR AC(VIM-EFR)

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR,10HZ	E=+1200F AIR,.67HZ		
DELTA K MIN	A: 12.11	.0962			
	B: 28.72		21.7		
	C:				
	D:				
	13.00	.218			
	16.00	.632			
	20.00	1.57			
	25.00	3.83			
	30.00	7.06	25.1		
	35.00	11.7	37.7		
	40.00	19.5	49.0		
DELTA K MAX	A: 45.38	35.7			
	B: 45.46		60.6		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		4.97	3.70		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION:HT
1750F 1HR AC, 1325F 8HR FC TO 1150F,
HELD 18HR AC(VIM-EFR)
FORM   0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH: 147.9 KSI
ULT. STRENGTH: 191.3 KSI
SPECIMEN THK: 0.298-   0.490"
SPECIMEN WIDTH: 1.153-   1.998"
REFERENCES:HD016
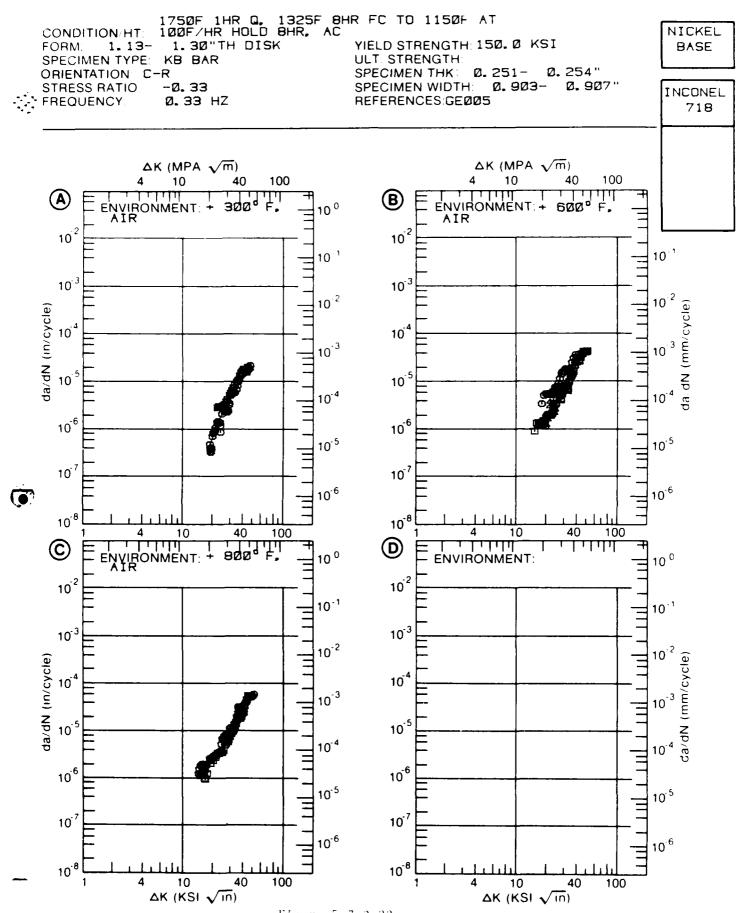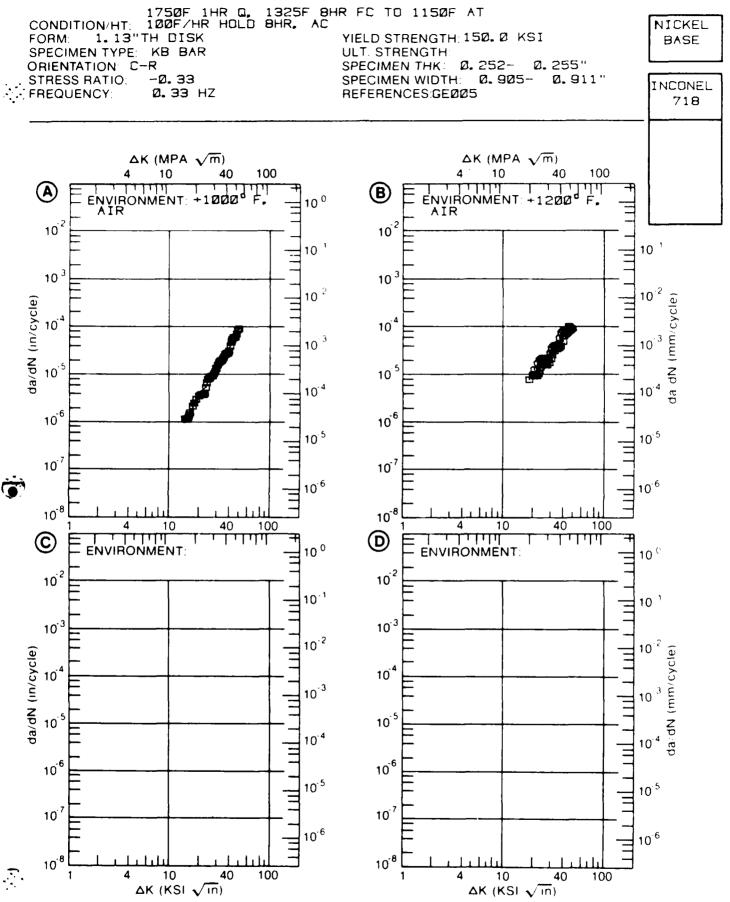
NICKEL
BASE

INCONEL
718

Figure 5.7.3.18

5.7-57

TABLE 5.7.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR AC, 1325F 8HR FC TO 1150F,   HELD 18HR AC
           (VIM-VAR)

ENVIRONMENT: R.T., LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05			
A:	16.56	1.63			
DELTA K B:					
MIN C:					
D:					
	20.00	2.99			
	25.00	6.28			
	30.00	12.1			
	35.00	22.4			
	40.00	40.0			
	50.00	122.			
A:	56.03	232.			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	5.04

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1750F 1HR AC. 1325F 8HR FC TO 1150F. HELD 18HR AC(VIM-VAR)
FORM: 0.63"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 8.33- 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 164.9 KSI
ULT. STRENGTH: 208.1 KSI
SPECIMEN THK: 0.301"
SPECIMEN WIDTH: 1.151"
REFERENCES: HD016

NICKEL BASE

INCONEL 718

A STRESS RATIO = +0.05
B STRESS RATIO =
C STRESS RATIO =
D STRESS RATIO =

ΔK (MPA √m)
ΔK (KSI √in)
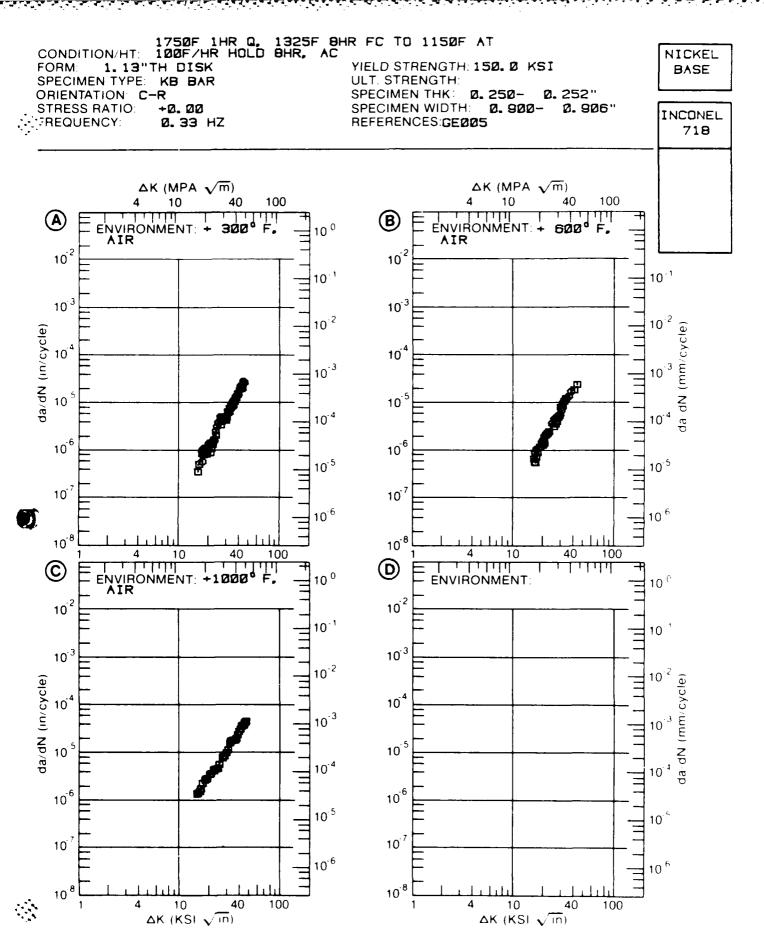da/dN (in/cycle)
da/dN (mm/cycle)

Figure 5.7.3.19

TABLE 5.7.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.20 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR AC,   1325F 8HR FC TO 1150F,   HELD 18HR AC
        (VIM-VAR)

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
DELTA K MIN	A: 13.90	1.13			
	B: 13.42		1.37		
	C: 12.74			1.93	
	D: 16.46				20.1
	13.00			2.06	
	16.00	2.01	2.70	3.88	
	20.00	4.34	5.66	7.07	34.6
	25.00	8.72	11.1	11.9	59.4
	30.00	16.0	19.4	17.2	83.4
	35.00	28.9	32.3	22.5	
	40.00		52.9		
DELTA K MAX	A: 37.80	40.5			
	B: 41.21		59.6		
	C: 39.66			27.2	
	D: 31.33				88.9

ROOT MEAN SQUARE PERCENT ERROR	4.62	3.55	7.73	2.35

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	1	1	1	1
1.25-2.0				
>2.0				

CONDITION/HT: HELD 18HR AC(VIM-VAR)

FORM: 0.63"TH FORGED BAR

SPECIMEN TYPE: CT

ORIENTATION: T-L

STRESS RATIO: +0.05

FREQUENCY: 0.67 HZ

YIELD STRENGTH: 164.9 KSI

ULT. STRENGTH: 208.1 KSI

SPECIMEN THK: 0.300- 0.302"

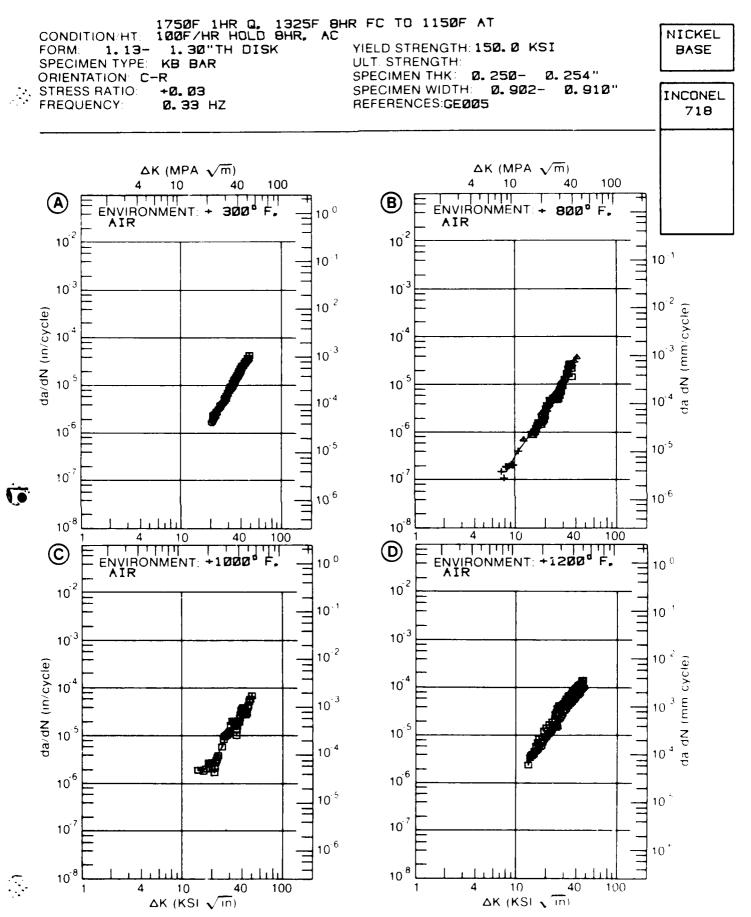SPECIMEN WIDTH: 1.152- 1.153"

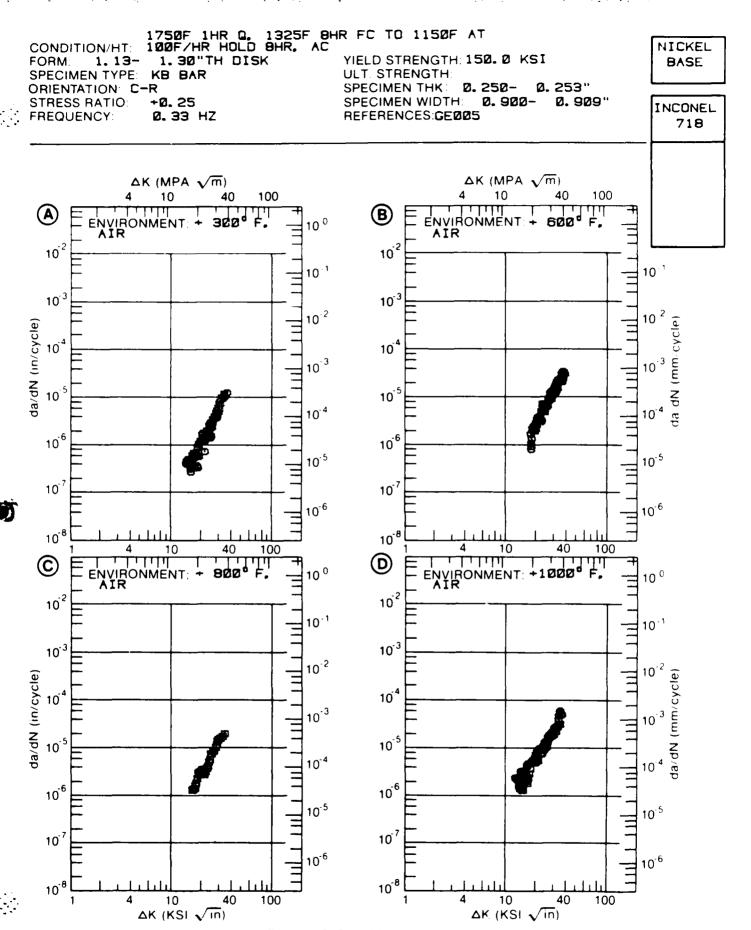REFERENCES: HD016

NICKEL BASE

INCONEL 718

Figure 5.7.3.20

TABLE 5.7.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
           100F/HR HOLD 8HR, AC
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.03			
DELTA K MIN	A:	16.37	2.25			
	B:					
	C:					
	D:					
		20.00	4.80			
		25.00	9.24			
		30.00	14.7			
		35.00	21.9			
		40.00	32.0			
DELTA K MAX	A:	47.47	56.9			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	8.74

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION HT. 1750F 1HR Q. 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR. AC

FORM 1.19"TH DISK
SPECIMEN TYPE KB BAR
ORIENTATION C-R
FREQUENCY 0.33 HZ
ENVIRONMENT +1000° F. AIR

YIELD STRENGTH 150.0 KSI
ULT STRENGTH
SPECIMEN THK 0.250"
SPECIMEN WIDTH 0.900- 0.902"
REFERENCES GE005

NICKEL
BASE

INCONEL
718

A: STRESS RATIO +0.03

B: STRESS RATIO

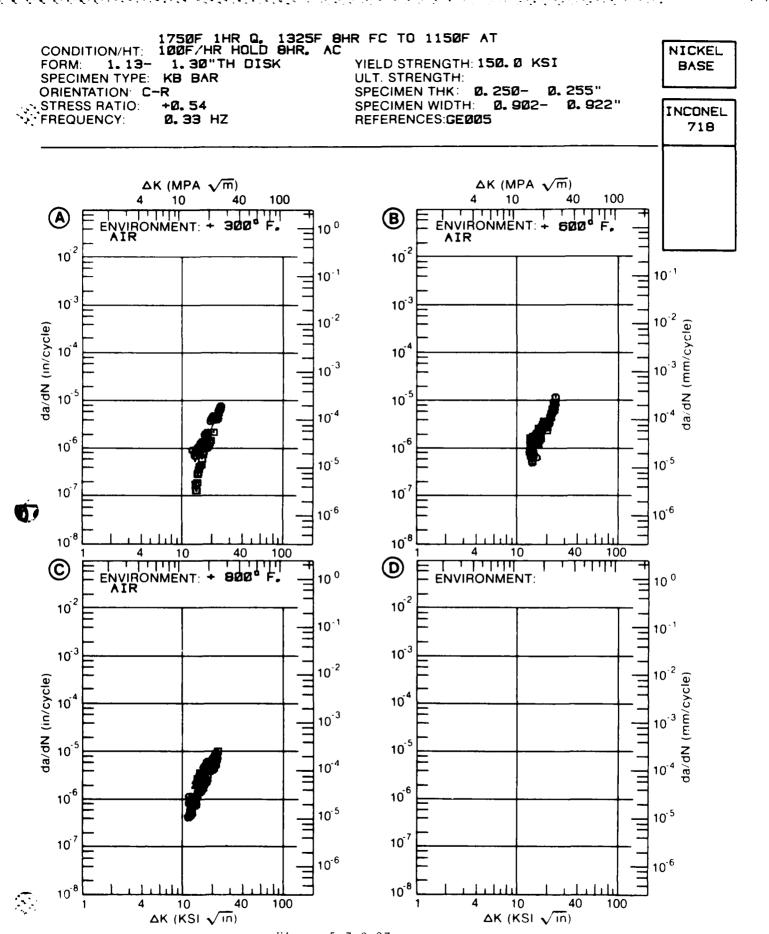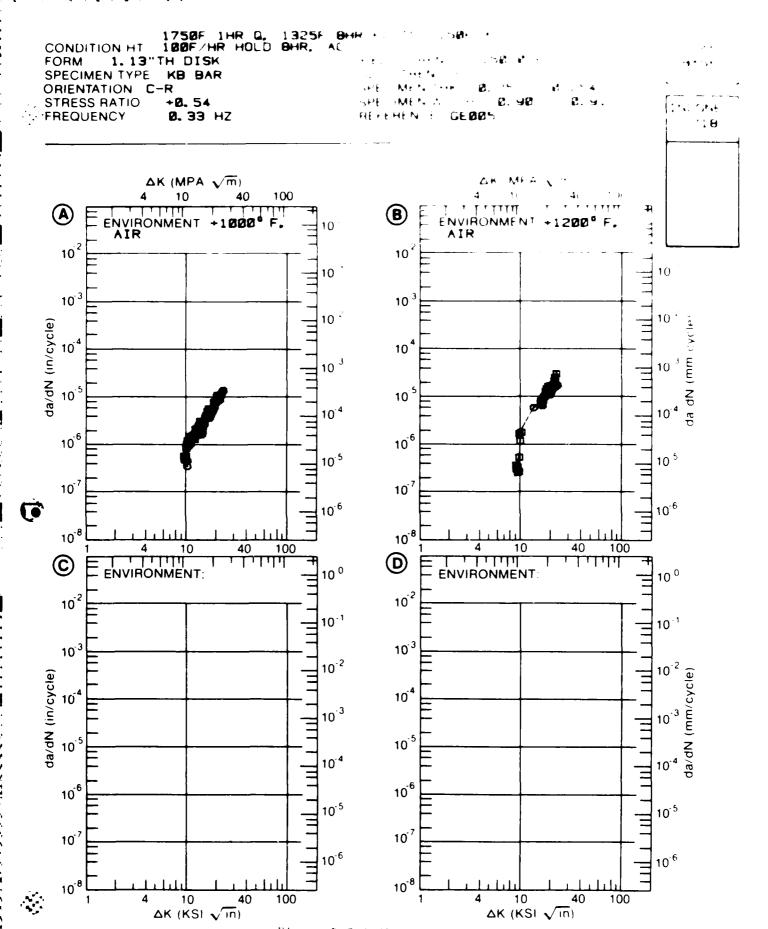C: STRESS RATIO

D

ΔK (MPA $\sqrt{m}$)

da/dN (in/cycle)

TABLE 5.7.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.22 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
       100F/HF HOLD 8HR, AC

DELTA K $(KSI*IN**1/2)$			DA/DN $(10**-6$ IN./CYCLE)			
			A	B	C	D
			E=+ 300F AIR	E=+ 600F AIR	E=+ 800F AIR	
DELTA K MIN	A	18.27	.43			
	B	14.98		1.06		
	C	14.17			1.20	
	D					
		15.00		1.20	1.42	
		20.00	.770	2.12	2.42	
		25.00	2.52	4.47	5.00	
		30.00	5.44	8.76	9.86	
		35.00	9.46	15.5	17.9	
		40.00	14.6	24.8	29.7	
		50.00			64.2	
DELTA K MAX	A	46.02	22.7			
	B	49.95		48.5		
	C	50.02			64.3	
	E					
MEAN SQUARE REGRESSION ERROR			26.22	48.34	19.07	

     5-.5
     6-.6
     8-.25
     6-.5

1750F 1HR Q. 1325F 8HR FC TO 1150F AT
CONDITION/HT: 100F/HR HOLD 8HR, AC
FORM: 1.13- 1.30"TH DISK   YIELD STRENGTH: 150.0 KSI
SPECIMEN TYPE: KB BAR   ULT STRENGTH:
ORIENTATION: C-R   SPECIMEN THK: 0.251- 0.254"
STRESS RATIO: -0.33   SPECIMEN WIDTH: 0.903- 0.907"
FREQUENCY: 0.33 HZ   REFERENCES:GE005
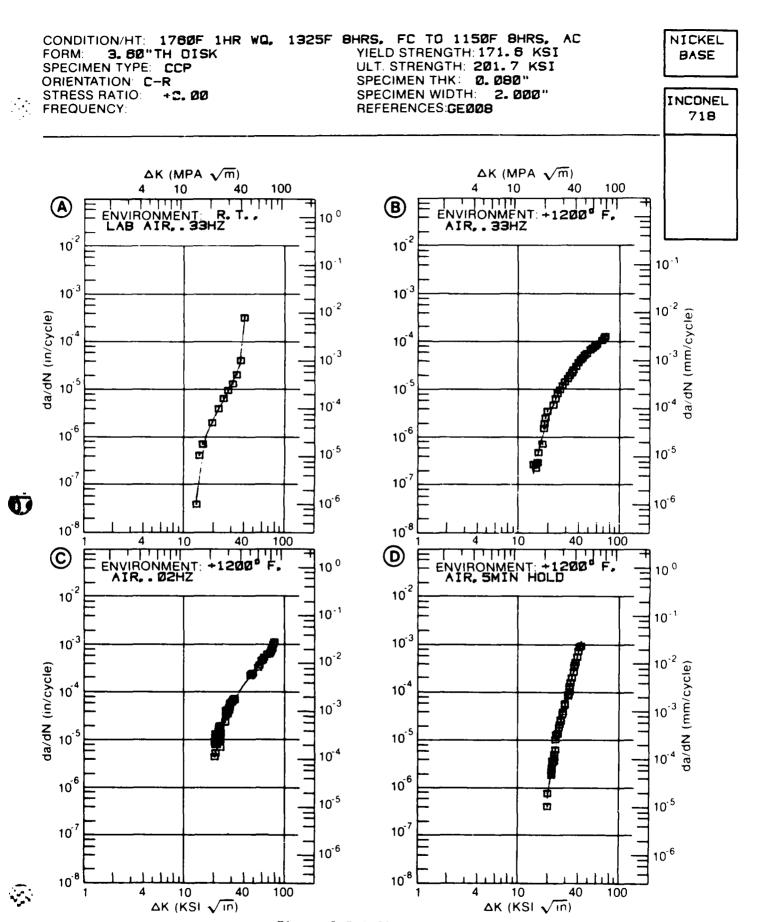
NICKEL
BASE

INCONEL
718

Figure 5.7.3.22

5.7-65

TABLE 5.7.3.23

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.23 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
           100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1000F	E=+1200F		
	AIR	AIR			
A: 13.89		.96			
DELTA K B: 17.86			8.13		
MIN C:					
D:					
16.00		1.68			
20.00		3.70	9.75		
25.00		7.77	16.8		
30.00		14.3	28.8		
35.00		24.6	45.6		
40.00		40.7	65.4		
A: 48.37		89.9			
DELTA K B: 48.27			95.9		
MAX C:					
D:					

| ROOT MEAN SQUARE PERCENT ERROR | 10.33 | 19.70 | | | |

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR. AC
FORM: 1.13"TH DISK
SPECIMEN TYPE: KB BAR   YIELD STRENGTH:150.0 KSI
ORIENTATION: C-R   ULT. STRENGTH:
STRESS RATIO: -0.33   SPECIMEN THK: 0.252- 0.255"
FREQUENCY: 0.33 HZ   SPECIMEN WIDTH: 0.905- 0.911"
                               REFERENCES:GE005

NICKEL
BASE

INCONEL
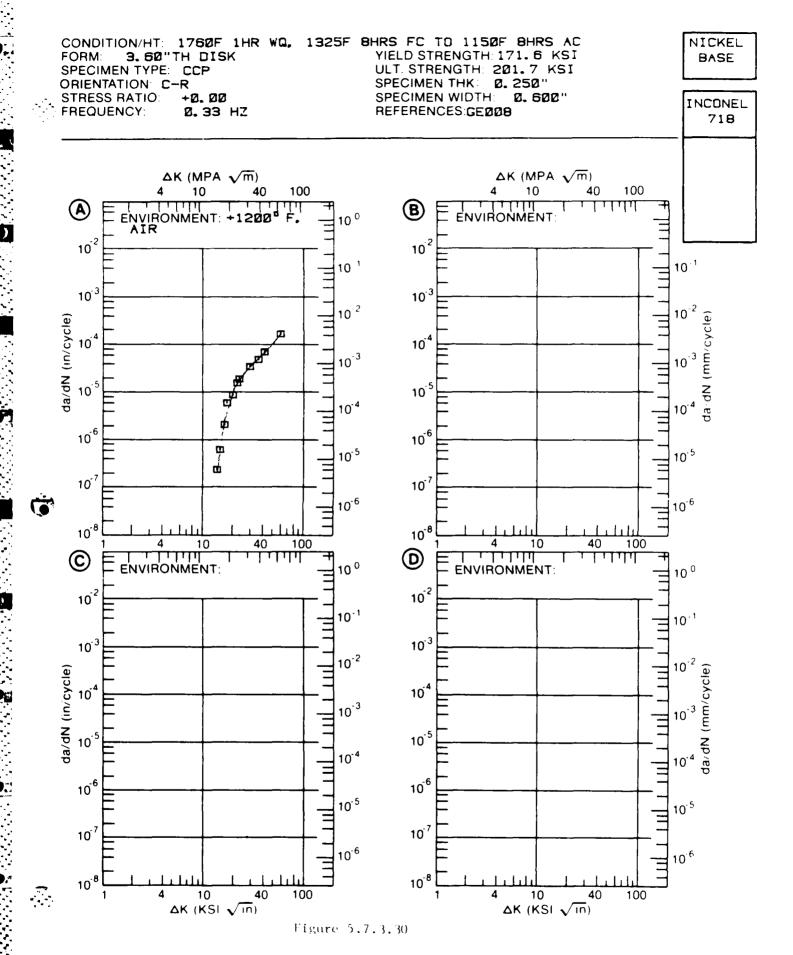718

Figure 5.7.3.23

TABLE 5.7.3.24

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.24 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
           100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 300F :AIR	E=+ 600F AIR	E=+1000F AIR	
A: 15.09		.485			
DELTA K B: 15.82			.589		
MIN C: 14.92				1.28	
D:					
16.00		.595	.626	1.70	
20.00		1.45	1.66	3.36	
25.00		3.38	3.66	5.95	
30.00		6.13	7.64	10.8	
35.00		11.0	13.9	19.1	
40.00		19.1	19.9	30.3	
A: 44.05		27.9			
DELTA K B: 42.52			21.5		
MAX C: 45.99				43.4	
D:					
ROOT MEAN SQUARE PERCENT ERROR		16.38	12.85	7.47	

LIFE   0.0-0.5
PREDICTION 0.5-0.8
 RATIO   0.8-1.25
 SUMMARY   1.25-2.0
 (NP/NA)   >2.0

CONDITION/HT: 100F/HR HOLD 8HR, AC
FORM: 1.13"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.252"
SPECIMEN WIDTH: 0.900- 0.906"
REFERENCES: GE005

NICKEL BASE

INCONEL 718

ΔK (MPA √m)

(A) ENVIRONMENT: + 300° F. AIR

(B) ENVIRONMENT: + 600° F. AIR

(C) ENVIRONMENT: +1000° F. AIR

(D) ENVIRONMENT:

da/dN (in/cycle)
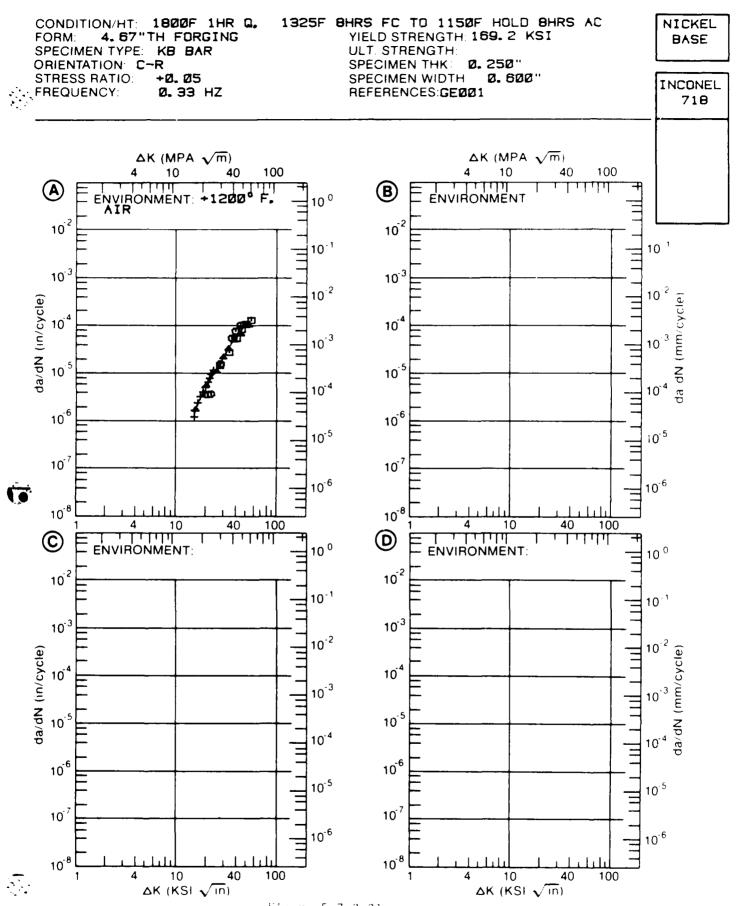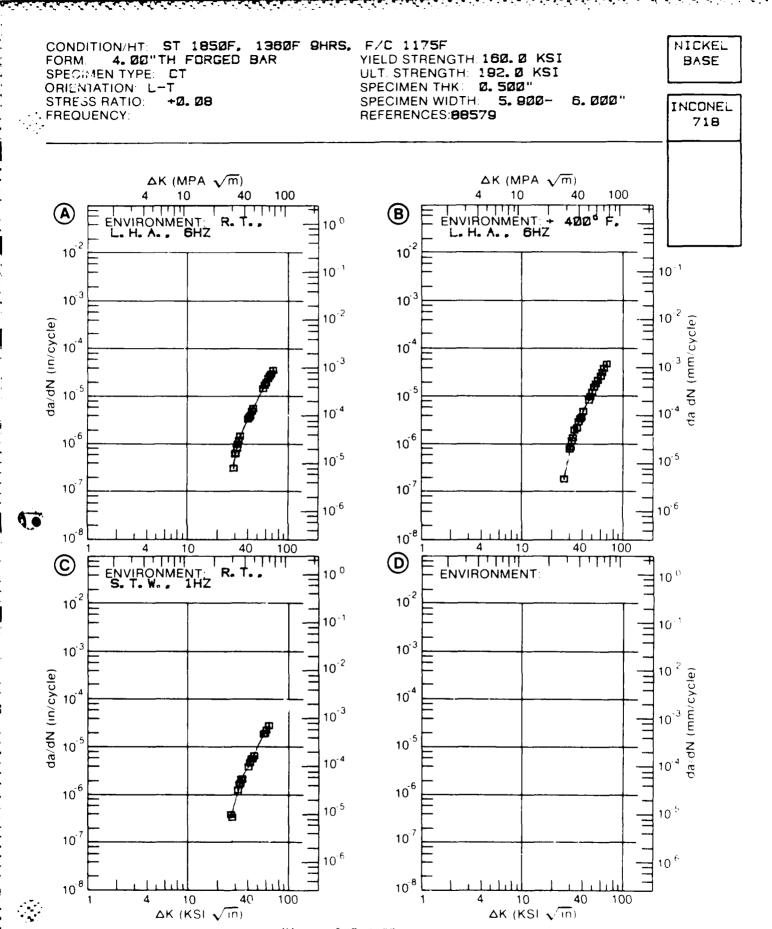
da dN (mm/cycle)

ΔK (KSI √in)

Figure 5.7.3.24

TABLE 5.7.3.25

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.25 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
            100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 300F AIR	E=+ 800F AIR	E=+1000F AIR	E=+1200F AIR
DELTA K MIN	A: 19.86	1.82			
	B: 7.10		.146		
	C: 14.19			1.84	
	D: 12.99				2.42
	8.00		.149		
	9.00		.221		
	10.00		.346		
	13.00		.749		2.44
	16.00		1.33	1.86	5.51
	20.00	1.86	2.67	2.59	9.92
	25.00	3.98	5.99	6.06	23.4
	30.00	7.94	12.4	14.5	42.7
	35.00	14.3	23.0	20.9	64.3
	40.00	23.4	38.5	27.6	86.3
DELTA K MAX	A: 47.23	40.8			
	B: 40.11		38.9		
	C: 49.01			65.2	
	D: 46.60				114.

ROOT MEAN SQUARE PERCENT ERROR	6.12	15.70	21.44	21.88

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT
100F/HR HOLD 8HR. AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.03
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT STRENGTH:
SPECIMEN THK: 0.250- 0.254"
SPECIMEN WIDTH: 0.902- 0.910"
REFERENCES: GE005
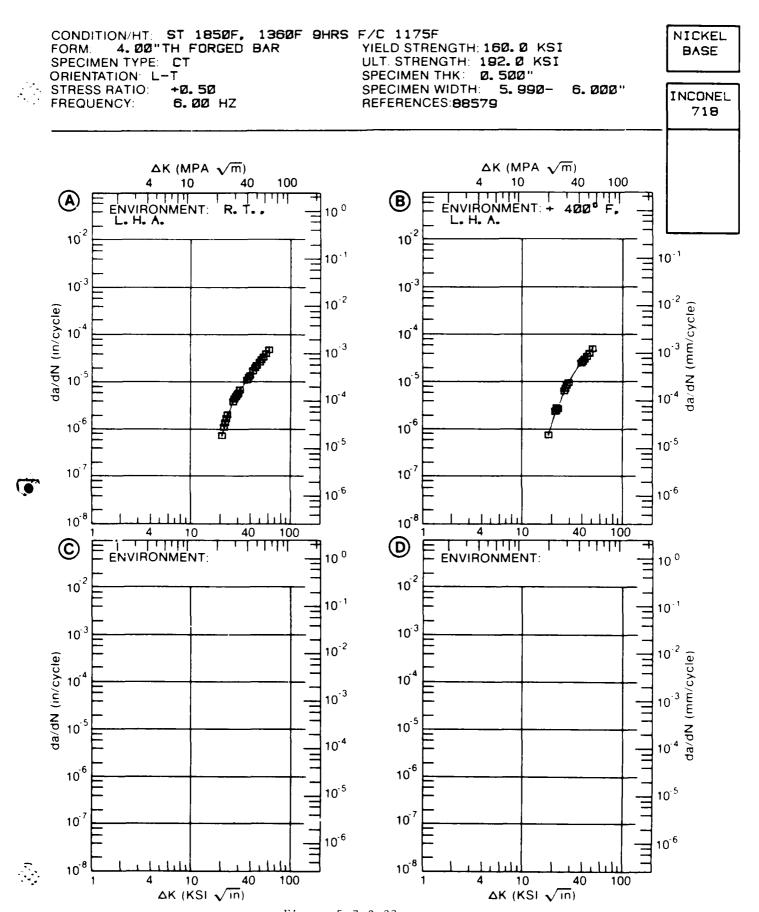
NICKEL
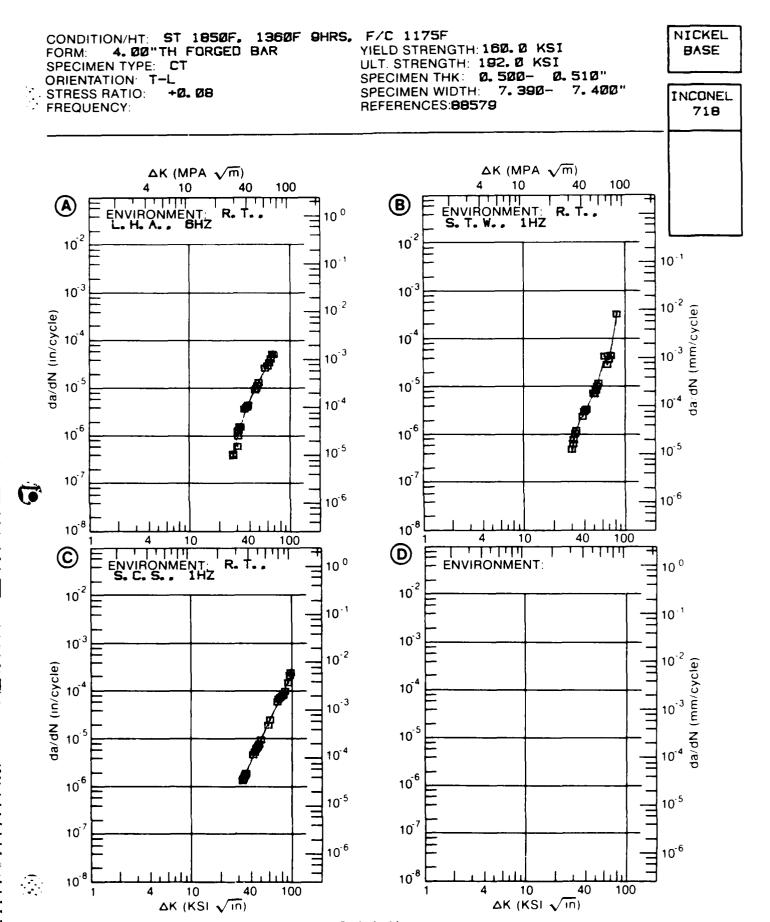BASE

INCONEL
718

Figure 5.7.3.25

TABLE 5.7.2.26

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.26 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
         100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 300F AIR	E=+ 600F AIR	E=+ 800F AIR	E=+1000F AIR
DELTA K MIN	A: 13.99	.523			
	B: 17.33		1.33		
	C: 15.78			1.36	
	D: 12.17				2.60
	13.00				1.81
	16.00	.395		1.41	2.69
	20.00	1.09	2.71	2.91	6.62
	25.00	2.30	6.74	6.95	12.5
	30.00	6.19	13.8	14.4	23.0
	35.00	11.8	24.5		54.6
DELTA K MAX	A: 35.84	12.0			
	B: 38.01		31.5		
	C: 33.30			21.3	
	D: 35.35				59.0
ROOT MEAN SQUARE PERCENT ERROR		21.76	16.02	15.70	20.84

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

1750F 1HR Q. 1325F 8HR FC TO 1150F AT
CONDITION/HT: 100F/HR HOLD 8HR, AC
FORM: 1.13- 1.30"TH DISK
SPECIMEN TYPE: KB BAR
ORIENTATION: C-R
STRESS RATIO: +0.25
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI
ULT. STRENGTH:
SPECIMEN THK: 0.250- 0.253"
SPECIMEN WIDTH: 0.900- 0.909"
REFERENCES: GE005
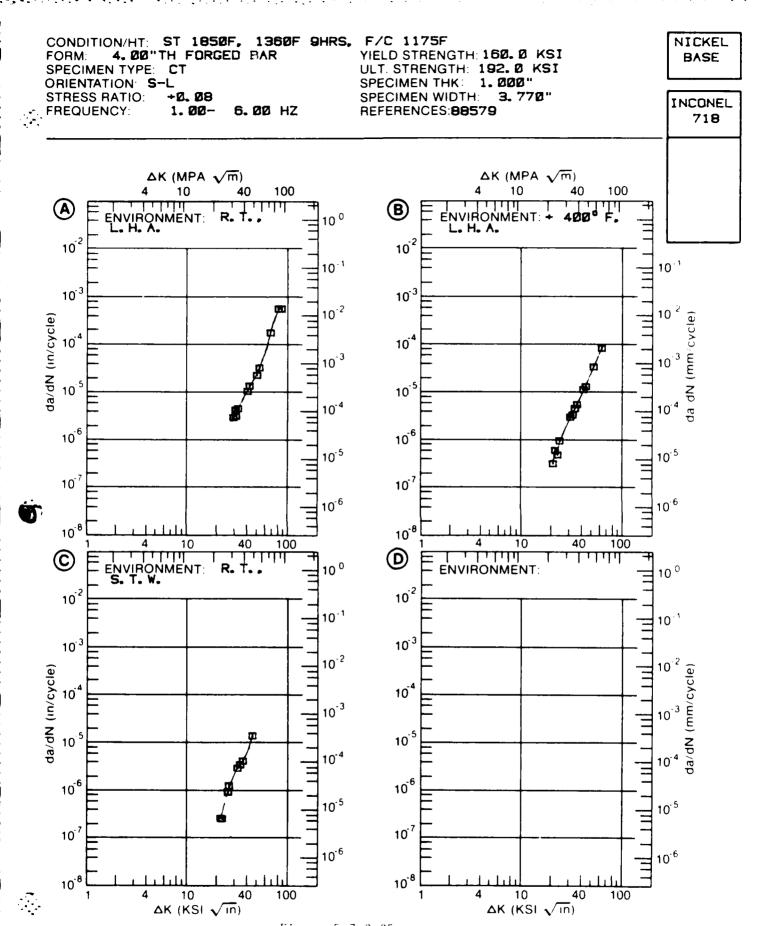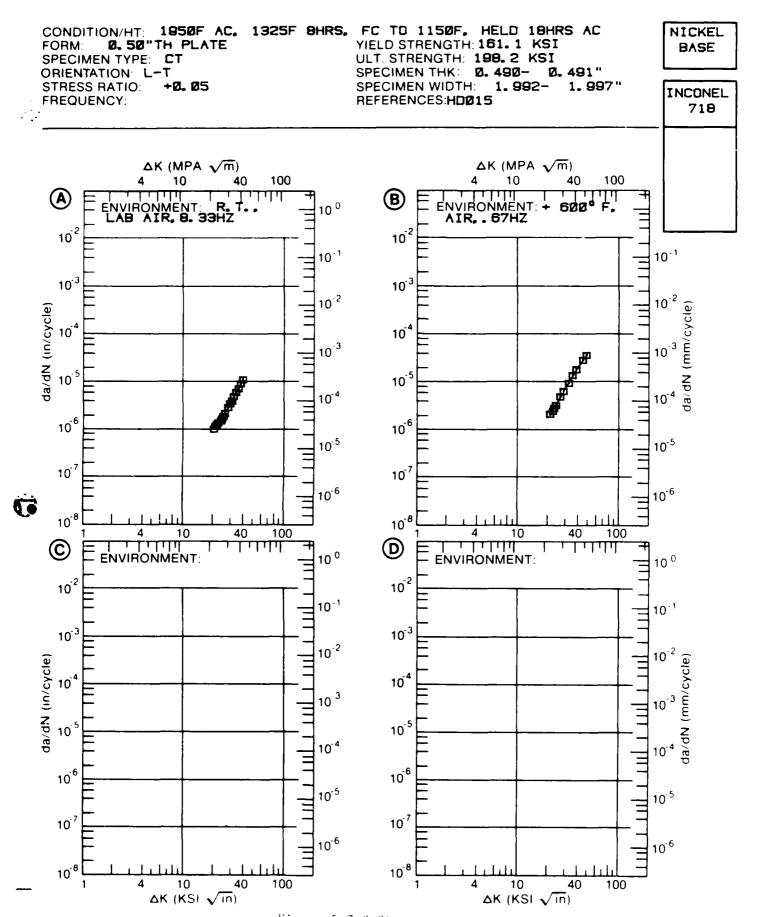
NICKEL BASE

INCONEL 718

Figure 5.7.3.26

5.7-73

TABLE 5.7.3.27

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.27 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
          100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 300F AIR	E=+ 600F AIR	E=+ 800F AIR	
DELTA K MIN	A: 12.37	.849			
	B: 12.93		1.09		
	C: 11.11			.647	
	D:				
	13.00	.518	1.07	1.12	
	16.00	1.08	1.95	3.31	
	20.00	3.25	3.74	5.86	
DELTA K MAX	A: 23.59	6.18			
	B: 23.39		10.2		
	C: 21.92			8.80	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	38.69	24.20	32.95	

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 1750F 1HR Q. 1325F 8HR FC TO 1150F AT 100F/HR HOLD 8HR. AC

FORM: 1.13- 1.30"TH DISK

SPECIMEN TYPE: KB BAR

ORIENTATION: C-R

STRESS RATIO: +0.54

FREQUENCY: 0.33 HZ

YIELD STRENGTH: 150.0 KSI

ULT. STRENGTH:

SPECIMEN THK: 0.250- 0.255"

SPECIMEN WIDTH: 0.902- 0.922"

REFERENCES:GE005

NICKEL BASE

INCONEL 718

Figure 5.7.3.27

5.7-75

TABLE 5.7.3.28

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.28 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1750F 1HR Q, 1325F 8HR FC TO 1150F AT
           100F/HR HOLD 8HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1000F AIR	E=+1200F AIR		
DELTA K MIN	A: 9.26	.412			
	B: 8.80		.348		
	C:				
	D:				
	9.00		.287		
	10.00	.857	2.12		
	13.00	2.19	5.73		
	16.00	4.03	8.45		
	20.00	8.45	16.0		
DELTA K MAX	A: 22.64	14.3			
	B: 22.63		22.0		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	18.59	24.72

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION HT 1750F 1HR Q. 1325F 8HR
           100F/HR HOLD 8HR. AC
FORM   1.13"TH DISK
SPECIMEN TYPE   KB BAR
ORIENTATION C-R
STRESS RATIO   +0.54
FREQUENCY   0.33 HZ

Figure 5.7.3.28

TABLE 5.7.3.29

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.29 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1760F 1HR WQ, 1325F 8HRS, FC TO 1150F
       8HRS, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR, .33HZ	E=+1200F AIR, .33HZ	E=+1200F AIR, .02HZ	E=+1200F AIR, 5MIN HOLD
DELTA K MIN A:	12.93	.0371			
DELTA K MIN B:	13.68		.172		
DELTA K MIN C:	19.60			7.05	
DELTA K MIN D:	19.03				.615
	13.00	.0525			
	16.00	1.02	.692		
	20.00	2.86	3.20	8.02	1.30
	25.00	6.85	9.59	27.7	18.0
	30.00	14.7	18.4	61.0	87.8
	35.00	32.3	28.3	106.	300.
	40.00		38.5	160.	953.
	50.00		60.7	294.	
	60.00		88.9	472.	
	70.00		130.	719.	
DELTA K MAX A:	39.18	324.			
DELTA K MAX B:	71.33		136.		
DELTA K MAX C:	77.64			978.	
DELTA K MAX D:	41.00				1205.

ROOT MEAN SQUARE PERCENT ERROR	19.82	18.82	20.92	29.11

LIFE   0.0-0.5
PREDICTION 0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 1780F 1HR WQ, 1325F 8HRS, FC TO 1150F 8HRS, AC
FORM: 3.80"TH DISK   YIELD STRENGTH:171.6 KSI
SPECIMEN TYPE: CCP   ULT. STRENGTH: 201.7 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.080"
STRESS RATIO: +C.00   SPECIMEN WIDTH: 2.000"
FREQUENCY: REFERENCES:GE008

NICKEL BASE

INCONEL 718

Figure 5.7.3.29

TABLE 5.7.3.80

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.80 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1760F 1HR WQ,   1325F 8HRS FC TO 1150F 8HRS AC

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=+1200F AIR			
DELTA K MIN	A:	13.48	.203			
	B:					
	C:					
	D:					
		16.00	2.44			
		20.00	11.7			
		25.00	24.2			
		30.00	37.5			
		35.00	51.6			
		40.00	67.3			
		50.00	110.			
DELTA K MAX	A:	58.25	167.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE   17.54
PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	.2 0

CONDITION/HT: 1760F 1HR WQ. 1325F 8HRS FC TO 1150F 8HRS AC
FORM: 3.60"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 171.6 KSI
ULT. STRENGTH: 201.7 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 0.600"
REFERENCES: GE008

NICKEL
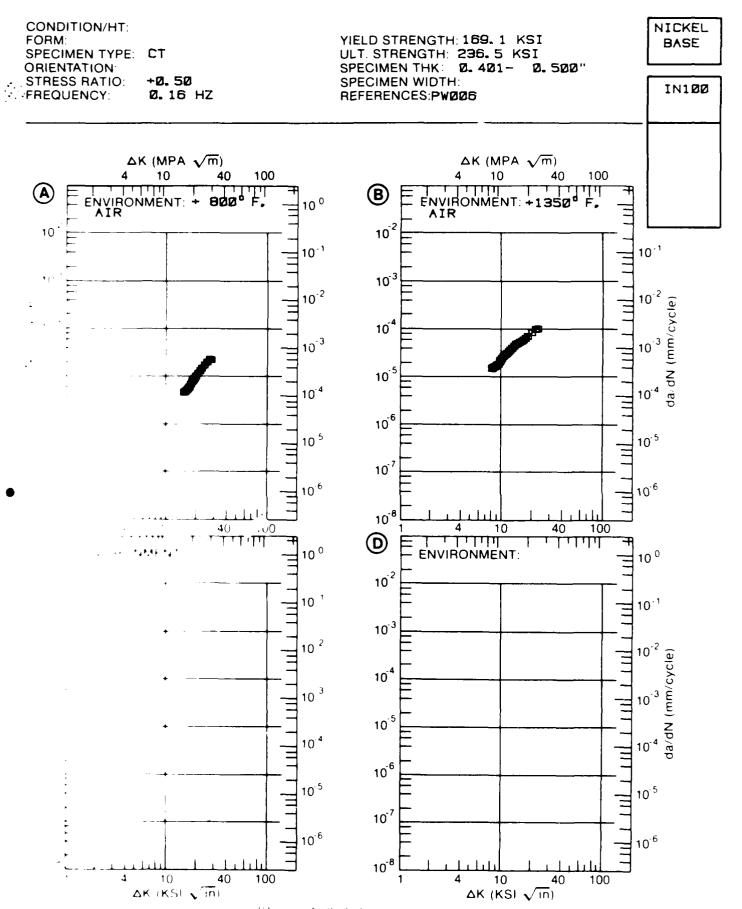BASE

INCONEL
718

Figure 5.7.3.30

TABLE 5.7.3.31

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.31 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1800F 1HR Q, 1325F 8HRS FC TO 1150F HOLD 8HRS AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F AIR			
A: 14.80		1.41			
DELTA K B:					
MIN C:					
D:					
16.00		2.35			
20.00		5.60			
25.00		11.9			
30.00		23.7			
35.00		42.7			
40.00		66.5			
50.00		106.			
A: 55.00		112.			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	18.01

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1800F 1HR Q. 1325F 8HRS FC TO 1150F HOLD 8HRS AC
FORM: 4.67"TH FORGING   YIELD STRENGTH: 169.2 KSI
SPECIMEN TYPE: KB BAR   ULT. STRENGTH:
ORIENTATION: C-R   SPECIMEN THK: 0.250"
STRESS RATIO: +0.05   SPECIMEN WIDTH 0.600"
FREQUENCY: 0.33 HZ   REFERENCES: GE001

NICKEL BASE

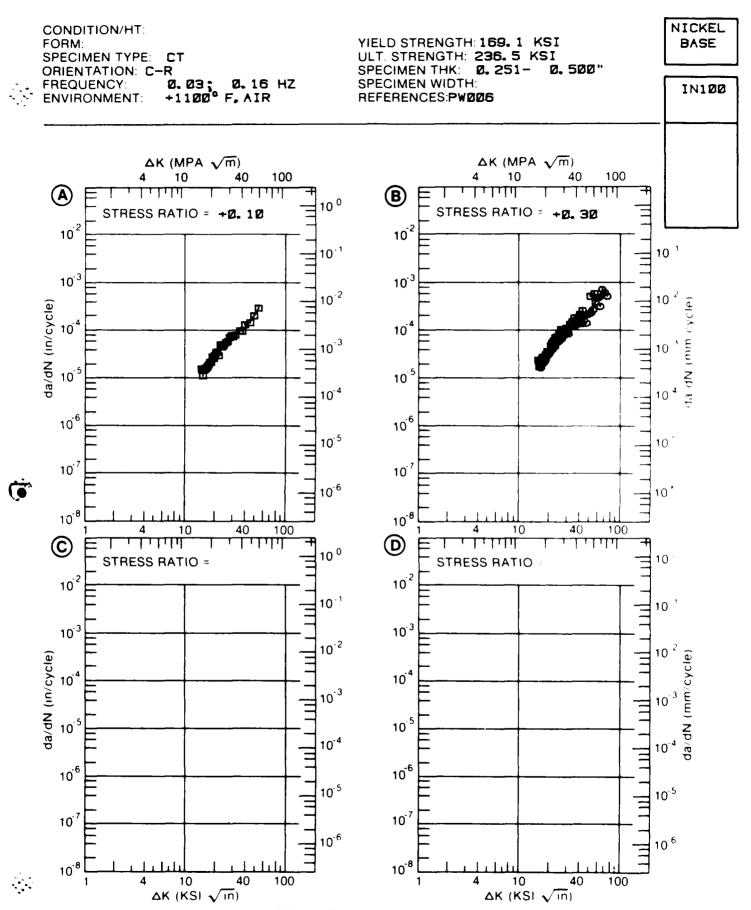INCONEL 718

Figure 5.7.3.31

5.7-83

TABLE 5.7.3.32

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.32 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A., 6HZ	E=+ 400F L.H.A., 6HZ	E= R.T. S.T.W., 1HZ	
DELTA K MIN	A: 27.73	.357			
	B: 25.53		.175		
	C: 26.20			.345	
	D:				
	30.00	.840	.963	.933	
	35.00	2.09	2.41	2.57	
	40.00	3.73	4.82	4.12	
	50.00	9.99	13.3	11.4	
	60.00	21.2	28.5	23.2	
DELTA K MAX	A: 69.11	34.8			
	B: 68.07		48.0		
	C: 62.69			27.2	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		6.46	6.32	9.48	

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: ST 1850F, 1360F 9HRS, F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 5.900- 6.000"
REFERENCES: 88579

NICKEL BASE

INCONEL 718

Figure 5.7.3.32

TABLE 5.7.3.33

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.33 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: ST 1850F, 1360F 9HRS F/C 1175F

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T.	E=+ 400F		
		L.H.A.	L.H.A.		
DELTA K MIN	A: 19.84	.710			
	B: 17.85		.738		
	C:				
	D:				
	20.00	.773	1.66		
	25.00	3.38	5.47		
	30.00	6.69	12.1		
	35.00	10.8	20.2		
	40.00	16.0	27.7		
	50.00	30.2			
DELTA K MAX	A: 59.27	47.0			
	B: 49.30		49.8		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		3.11	6.49		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8		1		
RATIO	0.8-1.25	1			
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: ST 1850F, 1360F 9HRS F/C 1175F
FORM: 4.00"TH FORGED BAR   YIELD STRENGTH:160.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 192.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.500"
STRESS RATIO: +0.50   SPECIMEN WIDTH: 5.990- 6.000"
FREQUENCY: 6.00 HZ   REFERENCES:88579
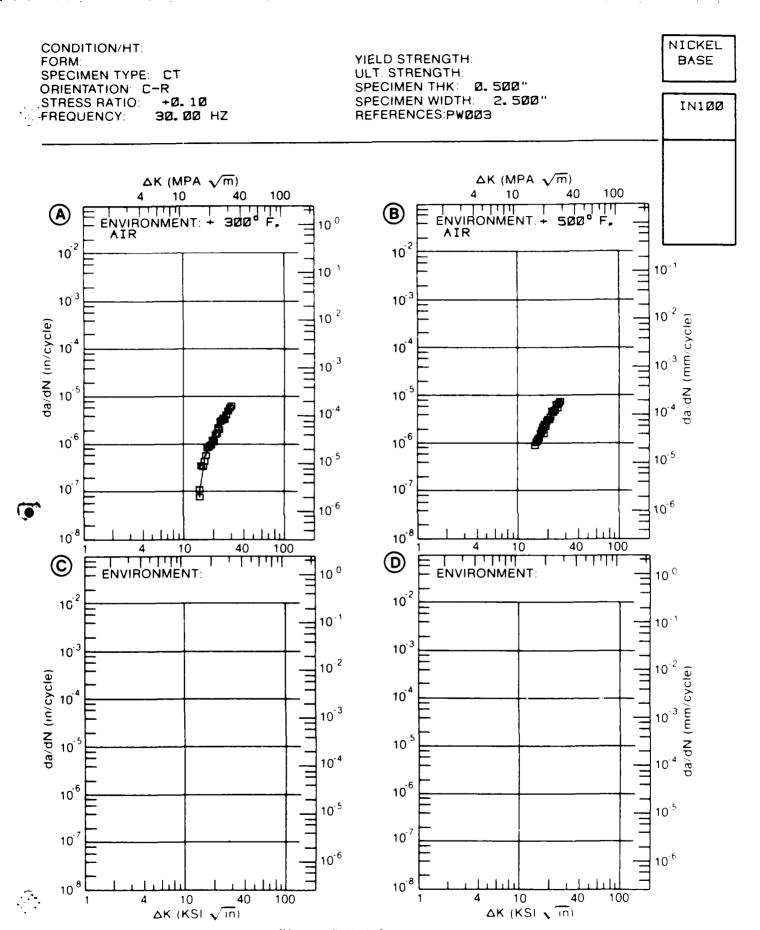
NICKEL
BASE

INCONEL
718

Figure 5.7.3.33

5.7-37

TABLE 5.7.3.34

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.34 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A., 6HZ	E= R.T. S.T.W., 1HZ	E= R.T. S.C.S., 1HZ	
DELTA K MIN	A: 26.21	.346			
	B: 28.93		.394		
	C: 31.51			1.18	
	D:				
	30.00	1.12	.631		
	35.00	3.13	1.93	2.18	
	40.00	6.30	2.82	3.92	
	50.00	16.1	8.61	11.0	
	60.00	32.9	27.8	25.8	
	70.00		40.5	50.3	
	80.00		208.	87.1	
	90.00			154.	
DELTA K MAX	A: 67.39	54.8			
	B: 81.34		306.		
	C: 95.99			225.	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	13.44	16.84	8.36

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8	1		
RATIO	0.8-1.25		1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: ST 1850F, 1360F 9HRS, F/C 1175F
FORM: 4.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 160.0 KSI
ULT. STRENGTH: 192.0 KSI
SPECIMEN THK: 0.500- 0.510"
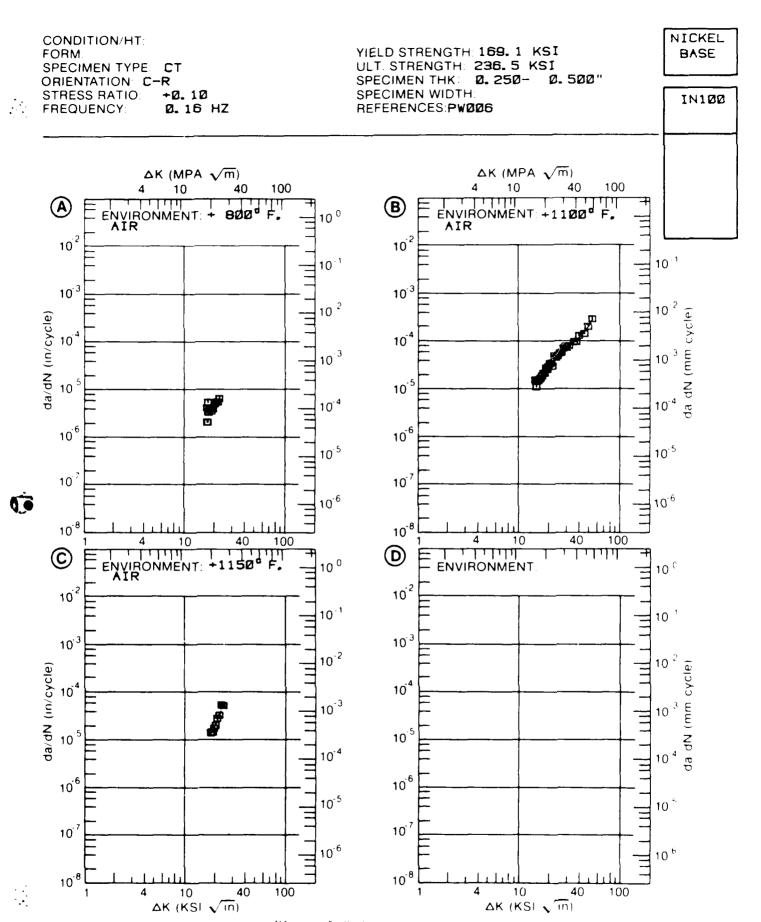SPECIMEN WIDTH: 7.390- 7.400"
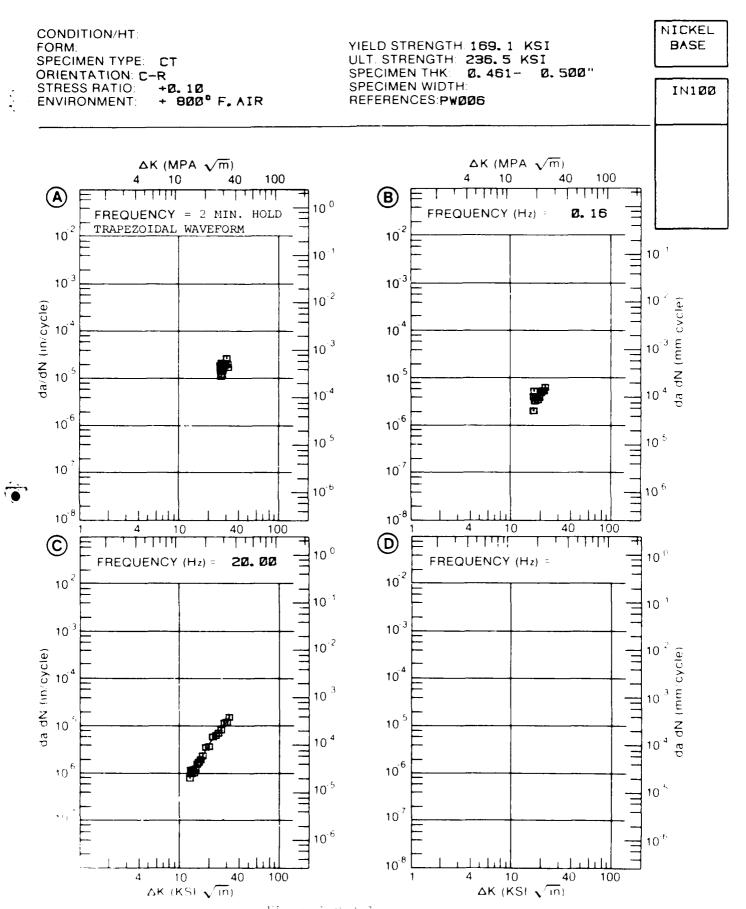REFERENCES: 88579

Figure 5.7.3.34

TABLE 5.7.3.35

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.35 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: ST 1850F, 1360F 9HRS, F/C 1175F

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. L.H.A.	E=+ 400F L.H.A.	E= R.T. S.T.W.	
DELTA K MIN	A:	28.21	2.84			
	B:	20.07		.335		
	C:	20.92			.253	
	D:					
		25.00		1.23	1.02	
		30.00	3.57	2.86	2.63	
		35.00	6.84	5.47	4.07	
		40.00	11.4	9.81	7.38	
		50.00	27.0	29.8		
		60.00	78.8	74.0		
		70.00	277			
		80.00	564.			
DELTA K MAX	A:	84.76	550.			
	B:	61.11		80.0		
	C:	43.46			13.5	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			8.98	13.52	13.99	
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5					
	0.5-0.8		1			
	0.8-1.25			1	1	
	1.25-2.0					
	>2.0					

CONDITION/HT: ST 1850F, 1360F 9HRS. F/C 1175F
FORM: 4.00"TH FORGED BAR   YIELD STRENGTH: 160.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 192.0 KSI
ORIENTATION: S-L   SPECIMEN THK: 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 3.770"
FREQUENCY: 1.00- 6.00 HZ   REFERENCES: 88579

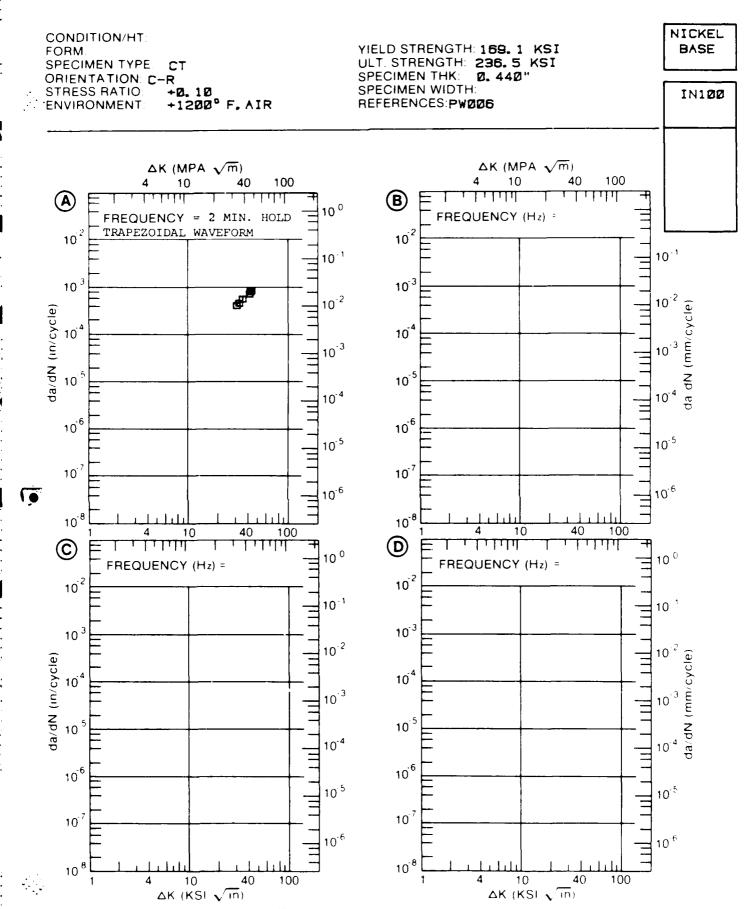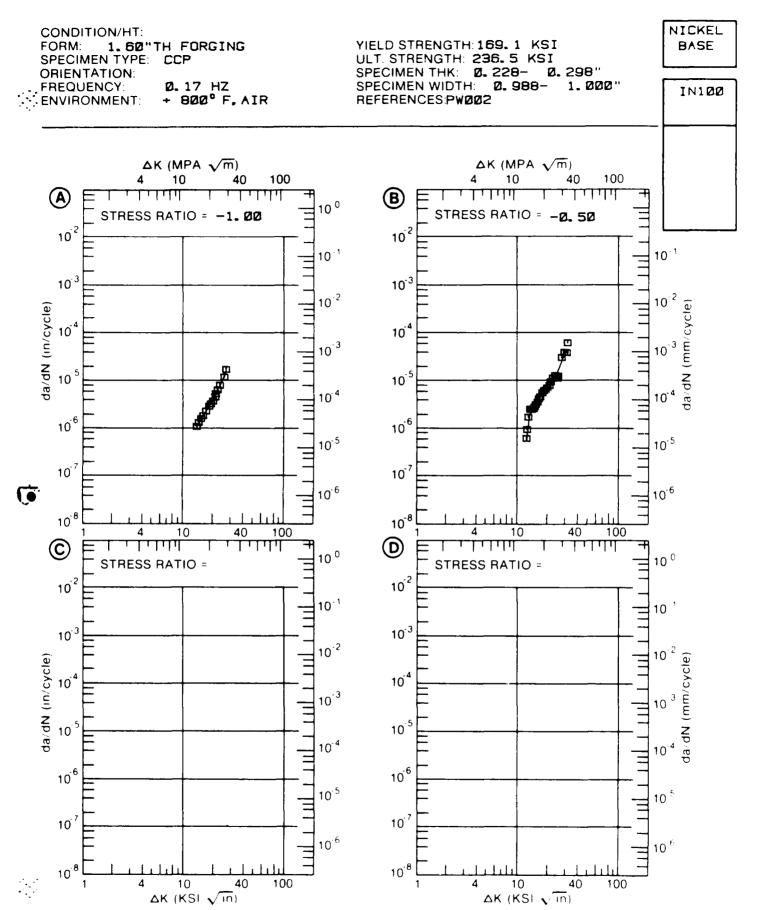NICKEL
BASE

INCONEL
718

Figure 5.7.3.35

5.7-91

TABLE 5.7.3.36

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.36 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1950F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR, 8.33HZ	E=+ 600F AIR, .67HZ		
DELTA K MIN A:	19.66	1.02			
DELTA K MIN B:	20.46		1.94		
DELTA K MIN C:					
DELTA K MIN D:					
	20.00	1.05			
	25.00	1.97	3.92		
	30.00	3.95	7.70		
	35.00	7.36	13.5		
	40.00		21.1		
DELTA K MAX A:	38.40	10.5			
DELTA K MAX B:	47.52		34.6		
DELTA K MAX C:					
DELTA K MAX D:					
ROOT MEAN SQUARE PERCENT ERROR		4.50	4.32		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: **1950F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC**
FORM: **0.50"TH PLATE**
SPECIMEN TYPE: **CT**
ORIENTATION: **L-T**
STRESS RATIO: **+0.05**
FREQUENCY:

YIELD STRENGTH: **161.1 KSI**
ULT. STRENGTH: **198.2 KSI**
SPECIMEN THK: **0.490- 0.491"**
SPECIMEN WIDTH: **1.992- 1.997"**
REFERENCES: **HD015**
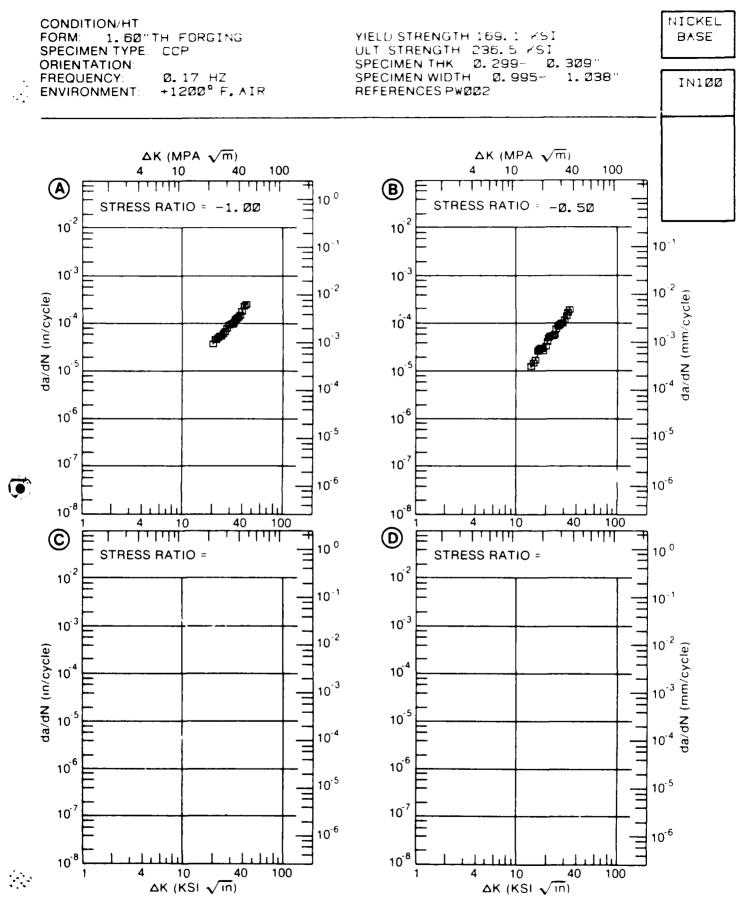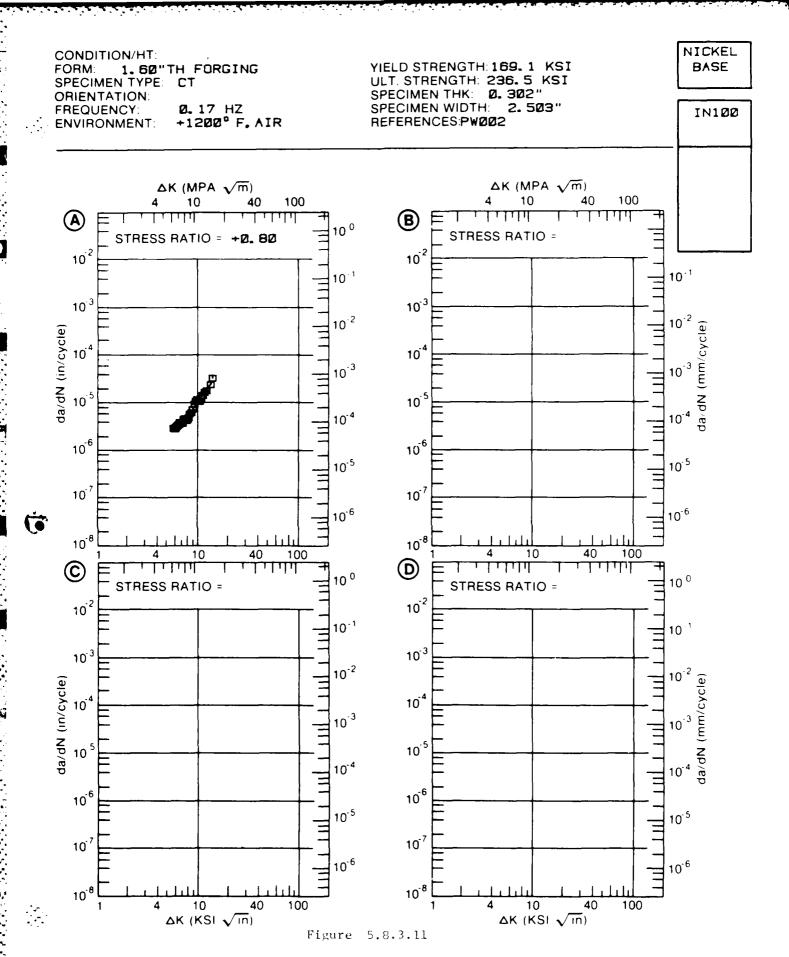
**NICKEL
BASE**

**INCONEL
718**

Figure 5.7.3.36

TABLE 5.7.3.37

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.7.3.37 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   INCONEL   718
CONDITION: 1950F AC, 1325 F 8HRS, FC TO 1150F, HELD 18HRS AC
ENVIRONMENT: +1000F, AIR

DELTA K $(KSI*IN**1/2)$		DA/DN $(10**-6$ IN /CYCLE)			
		A	B	C	D
		R=+0 05			
DELTA K MIN	A: 21 00	4 93			
	B:				
	C:				
	D:				
	25 00	7 94			
	30 00	1` `			
	35 00	‹‹ ‹			
	40 00	3` ,			
DELTA K MAX	A 46 5‹	‹ ‹			
	B				
	C				
	D				

ROOT MEAN SQUARE
 PERCENT ERROR

LIFE	O O
PREDICTION	O 5
RATIO	O ‹
SUMMARY	1 2‹
(NP/NA)	

CONDITION/HT: **1950F AC. 1325F 8HRS. FC TO 1150F. HELD 18HRS AC**

FORM: **0.50"TH PLATE**	YIELD STRENGTH: **161.1 KSI**
SPECIMEN TYPE: **CT**	ULT. STRENGTH: **198.2 KSI**
ORIENTATION: **T-L**	SPECIMEN THK: **0.490"**
FREQUENCY: **0.67 HZ**	SPECIMEN WIDTH: **1.996- 1.998"**
ENVIRONMENT: **+1000° F, AIR**	REFERENCES: **HD015**

NICKEL
BASE

INCONEL
718
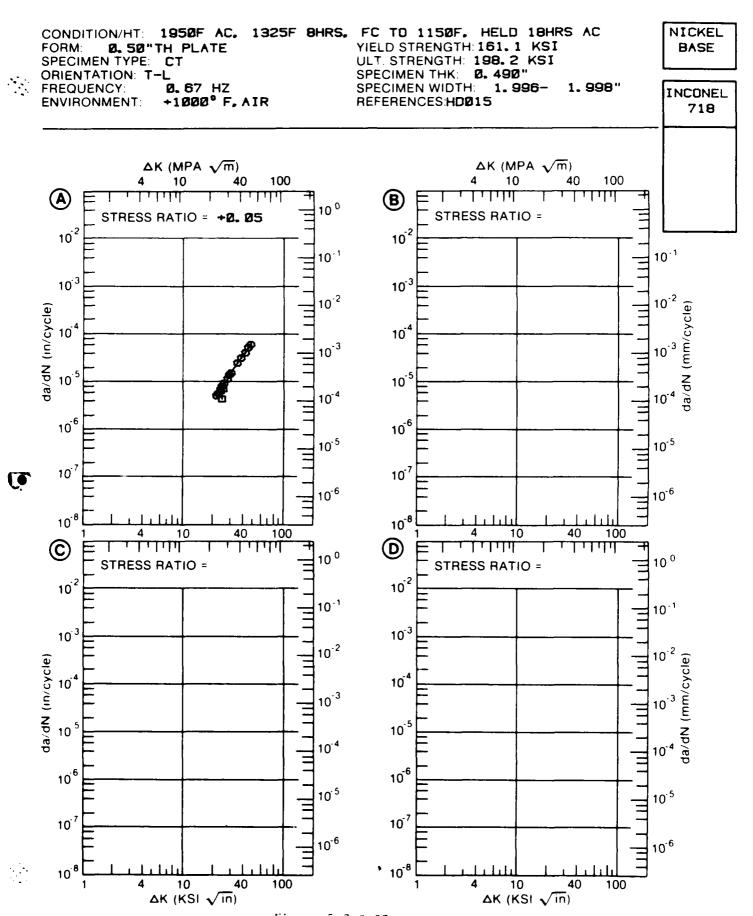
Figure 5.7.3.37

Table 5.7.3.33

NICKEL BASE   INCONEL 718   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SQ)	CRACK LENGTH (IN) A	K(Q)	K(ISCC) MEAN (KSI*SQRT IN)	STAN DEV	TEST TIME (MIN)	DATE	REFER
1850F 1.5HR OQ,1360F 9HRS, FC TO 1175F	FB	4.00 4.00	R.T.	L-T	160.0 160.0	S.C.S.	2.000 2.000	1.000 1.000	DCB DCB	--- ---	103.00 103.00	>166.00 > 86.00		60180 60180	1976 1976	R1006 R1006
1850F 1.5HR OQ,1360F 9HRS, FC TO 1175F	FB	4.00 4.00	R.T.	L-T	160.0 160.0	S.T.W.	2.000 2.000	1.000 1.000	DCB DCB	--- ---	103.00 103.00	> 86.00 >180.00		60060 119100	1976 1976	R1006 R1006
1850F 1.5HR OQ,1360F 9HRS, FC TO 1175F	FB	4.00 4.00	R.T.	T-L	160.0 160.0	S.T.W.	2.000 2.000	1.000 1.000	DCB DCB	--- ---	104.00 104.00	> 89.00 121.00		60060 119100	1976 1976	R1006 R1006
1850F 1.5HR OQ,1360F 9HRS, FC TO 1175F	FB	4.00 4.00	R.T.	S-L	160.0 160.0	S.T.W.	2.000 2.000	1.000 1.000	DCB DCB	--- ---	104.00 104.00	> 87.00 > 99.00		60120 76380	1976 1976	R1006 R1006
1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	S	0.13	R.T.	---	---	AEROZINE 50	1.300	0.125	WOL	---	---	80.00*		---	1974	88700
1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	S	0.13	R.T.	---	---	MARTIN-MARIETTA REFINED GRADE HYDRAZINE	1.300	0.125	WOL	---	---	79.00*		---	1974	88700
1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	S	0.13	R.T.	---	---	MARTIN-MARIETTA REFINED GRADE HYDRAZINE-2PCT OXYGEN	1.300	0.125	WOL	---	---	79.00*		---	1974	88700
1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	S	0.13	R.T.	---	---	MATHESON-COLEMAN-BELL 97PCT GRADE HYDRAZINE	1.300	0.125	WOL	---	---	25.80*		---	1974	88700
1880F 1HR AC 1520F 8HR FC 1200F 16HR AC	S	0.13	R.T.	---	---	PROPELLANT GRADE HYDRAZINE	1.300	0.125	WOL	---	---	87.50*		---	1974	88700

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

Table 5.8.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN
ORIENTATION Unknown

ENVIRONMENT: AIR AT 800 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS: (KSI SQRT(IN)) FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	10	20	50	100
	FORGING	-1.00	0.17				4.11		
	FORGING	-0.50	0.17				7.09		

Table 5.8.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN
ORIENTATION Unknown

ENVIRONMENT: AIR AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
	FORGING	-1.00	0.17					38.5		
	FORGING	-0.50	0.17					40.9	3081	
	FORGING	0.10	0.17				10.7			
	FORGING	0.80	0.17							

Table 5.8.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100

TEST CONDITIONS

SPECIMEN
ORIENTATION   C R

ENVIRONMENT   AIR
AT 1200 F

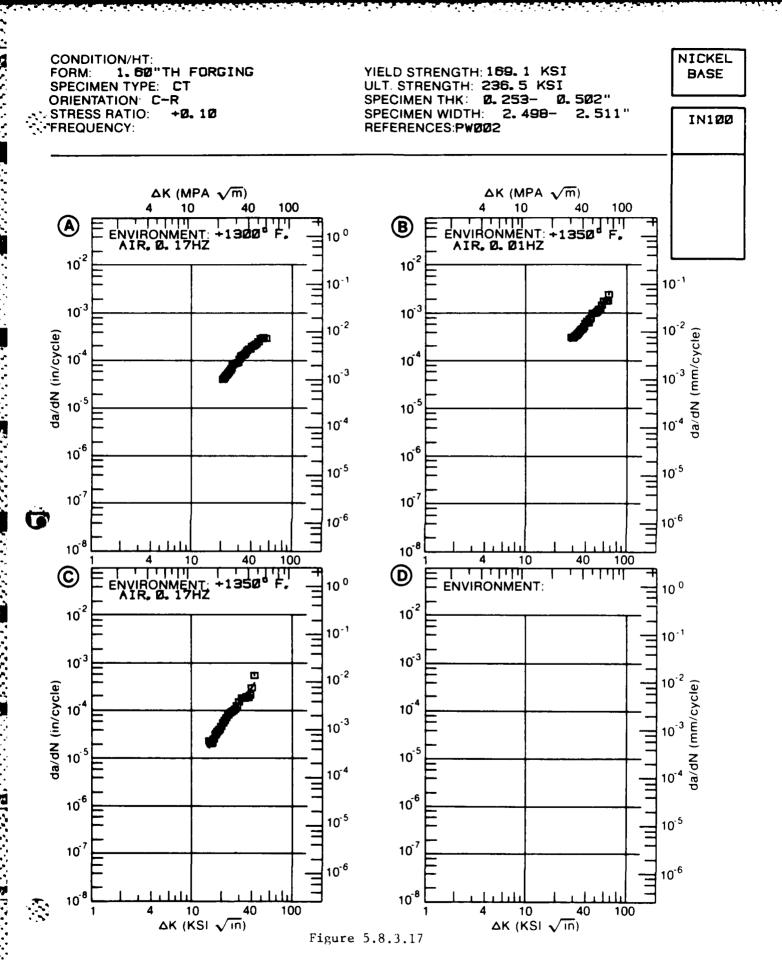| CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2 5	5	10	20	50	100
	FORGING	0 10	0 01					36 9	492	
	FORGING	0 10	0 17					35 3	239	
	FORGING	0 10	0 17					27 6		
	FORGING	0 10	20 00					8 16		
	FORGING	0 50	0 17				4 63	44 1		
	FORGING	0 05	20 00					7 10		
	FORGING	0 80	0 17				19 5			
	FORGING	0 80	20 00			0 60	2 69			

TABLE 5.8.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

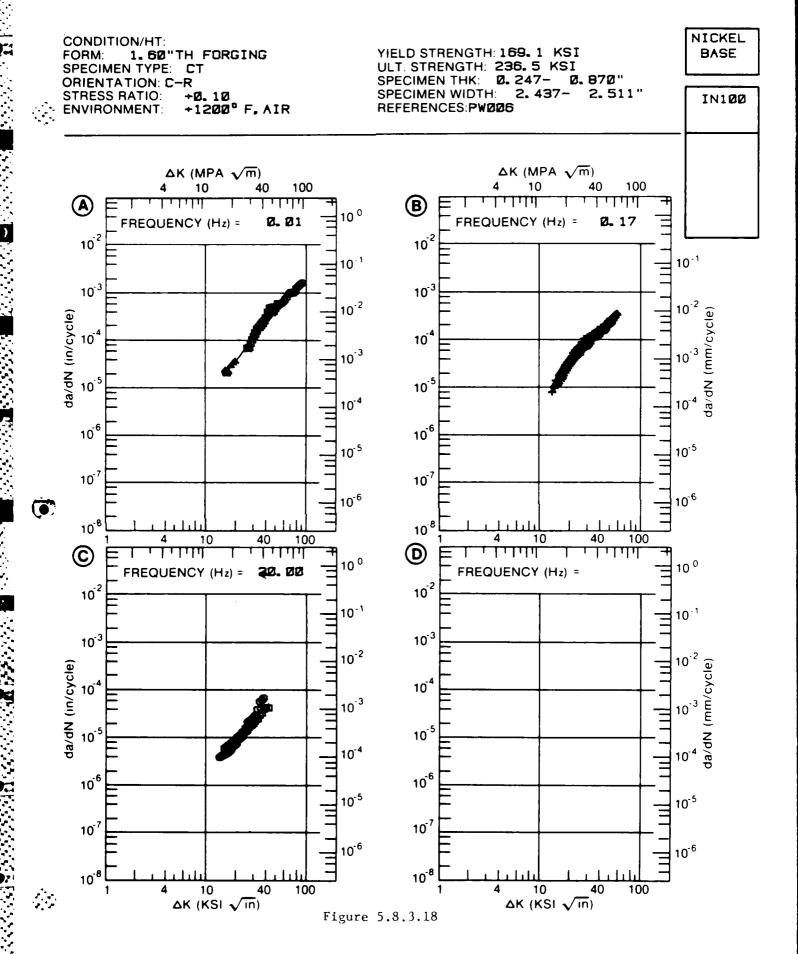### DATA ASSOCIATED WITH FIGURE 5.8.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   IN100
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN /CYCLE)			
	:	A	B	C	D
	:	E=+ 800F	E=+1350F		
	:AIR		AIR		
A: 14.67 :		4.32			
DELTA K B: 7.98 :			13.7		
MIN C:					
D:	:				
8.00 :			13 8		
9.00 :			18 9		
10.00 :			24 4		
13.00 :			41 5		
16.00 :		5.39	59 2		
20.00 :		10.8	84 9		
25.00 :		19.8			
A: 27.30 :		22.9			
DELTA K B: 22.70 :			105		
MAX C:					
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	3.22	3 9E

LIFE   0.0-0.5
PREDICTION   0.5-0 8
RATIO   0.8-1.25
SUMMARY   1.25-2 0
(NP/NA)   >2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.50
FREQUENCY: 0.16 HZ

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.401- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL
BASE

IN100

Figure 5.8.3.1

TABLE 5.8.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.2   INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1100F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.10	R=+0.30		
A: 14.26	:	12.8			
DELTA K B: 14.98	:		14.8		
MIN C:	:				
D:	:				
16.00	:	16.7	19.8		
20.00	:	31.7	43.3		
25.00	:	55.3	74.7		
30.00	:	76.9	105.		
35.00	:	97.8	138.		
40.00	:	123.	176.		
50.00	:	228.	289.		
60.00	:		466.		
70.00	:		593.		
A: 52.90	:	289.			
DELTA K B: 72.77	:		601.		
MAX C:	:				
D:	:				
ROOT MEAN SQUARE PERCENT ERROR		9.12	21.12		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.03;   0.16 HZ
ENVIRONMENT: +1100° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.251- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL
BASE

IN100

Figure 5.8.3.2

TABLE 5.8.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
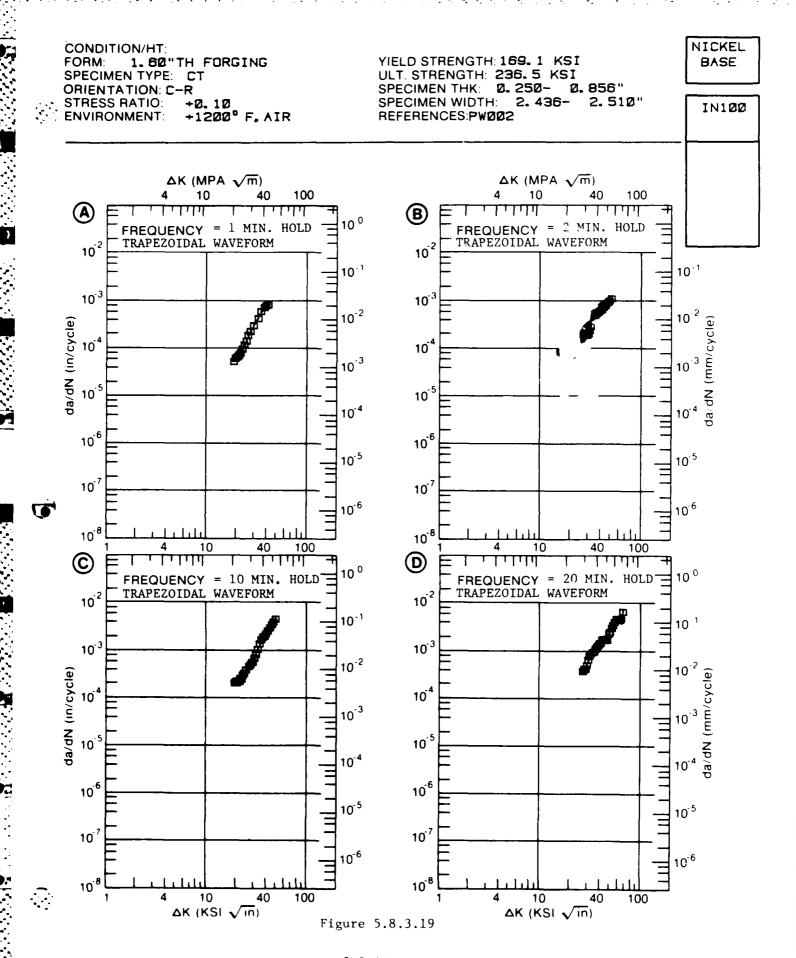
DATA ASSOCIATED WITH FIGURE 5.8.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05	R=+0.10		
DELTA K MIN	A: 15.48	7.64			
	B: 24.21		10.0		
	C:				
	D:				
	16.00	8.62			
	20.00	26.2			
	25.00	54.9	10.6		
	30.00	74.2	15.5		
	35.00	91.0			
	40.00	116.			
	50.00	250.			
DELTA K MAX	A: 50.85	272.			
	B: 30.86		15.9		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	9.69	7.90

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

NICKEL
BASE

IN100

ΔK (MPA $\sqrt{m}$)

A　STRESS RATIO = +0.05

da dN (in cycle)

ΔK (MPA $\sqrt{m}$)

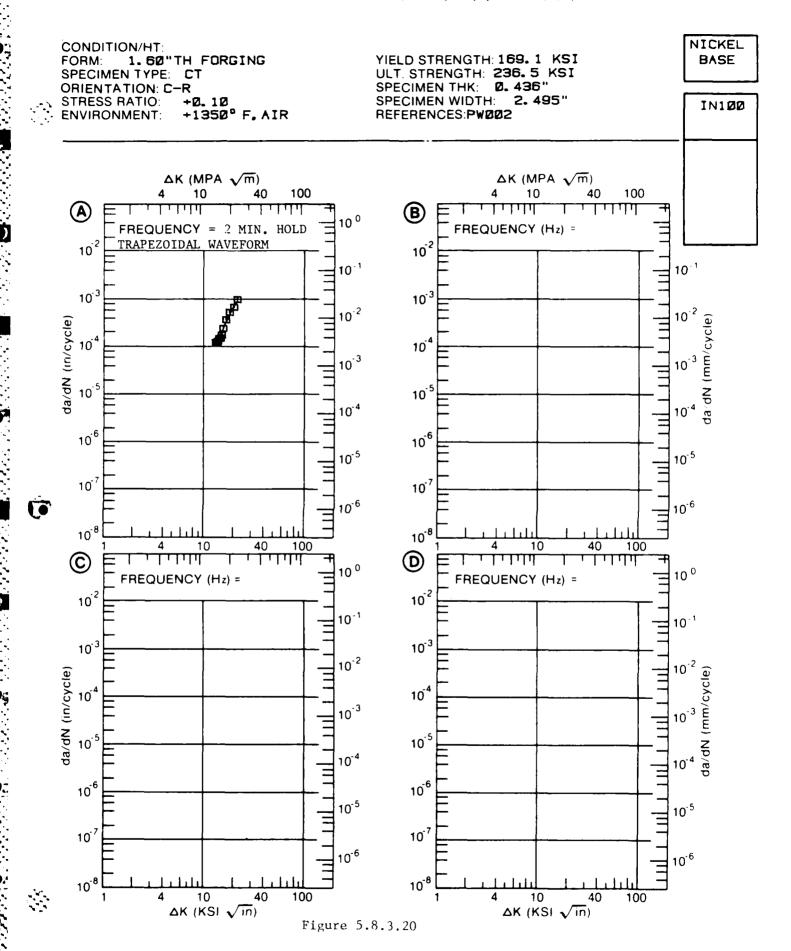B　STRESS RATIO = +0.10

da dN (mm cycle)

C

TABLE 5.8.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1350F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.10			
DELTA K MIN	A: 14.82	:	60.0			
	B:	:				
	C:	:				
	D:	:				
	16.00	:	69.9			
	20.00	:	117.			
	25.00	:	217.			
	30.00	:	378.			
	35.00	:	623.			
	40.00	:	977.			
DELTA K MAX	A: 42.68	:	1221.			
	B:	:				
	C:	:				
	D:	:				

ROOT MEAN SQUARE   11.54
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: MIXED
ENVIRONMENT: +1350° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.246"
SPECIMEN WIDTH:
REFERENCES: PW006

Figure 5.8.3.4

TABLE 5.8.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   IN100
CONDITION:

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=+ 300F	E=+ 500F		
		: AIR		AIR		
DELTA K MIN	A:	14.09	.0917			
	B:	14.58		.871		
	C:					
	D:					
		16.00	.556	1.30		
		20.00	1.42	3.12		
		25.00	3.59	6.47		
DELTA K MAX	A:	29.38	6.54			
	B:	26.09		7.31		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	15.79	8.94

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 30.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES:PW003

NICKEL
BASE

IN100

Figure 5.8.3.5

TABLE 5.8.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   IN100
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 800F AIR	E=+1100F AIR	E=+1150F AIR	
DELTA K MIN	A: 16.43	3.24			
	B: 14.26		13.2		
	C: 17.57			13.7	
	D:				
	16.00		16.4		
	20.00	4.71	32.2	22.2	
	25.00		55.4		
	30.00		75.6		
	35.00		96.8		
	40.00		124.		
	50.00		227.		
DELTA K MAX	A: 21.80	6.30			
	B: 52.90		279.		
	C: 23.45			53.8	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	22.76	8.93	10.20

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 0.16 HZ

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250- 0.500"
SPECIMEN WIDTH:
REFERENCES:PW006

Figure 5.8.3.6

TABLE 5.8.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.7 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)		A	B	C	D
		F=2 MIN HOLD TRAPEZOIDAL	F(HZ)= 0.16	F(HZ)= 20.00	
DELTA K MIN	A: 25.35	15.9			
	B: 16.43		3.24		
	C: 12.40			.919	
	D:				
	13.00			1.02	
	16.00			2.01	
	20.00		4.71	4.58	
	25.00			8.07	
	30.00	21.4		13.7	
DELTA K MAX	A: 30.46	16.6			
	B: 21.80		6.30		
	C: 30.78			15.3	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		17.04	22.76	9.62	

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.461- 0.500"
SPECIMEN WIDTH:
REFERENCES: PW006

Figure 5.8.5.7

TABLE 5.8.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.8 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2) :	DA/DN (10**-6 IN./CYCLE)			
:	A	B	C	D
:				
: F=2 MIN HOLD				
: TRAPEZOIDAL				
:				
A: :				
DELTA K B: :				
MIN C: :				
D: :				
:				
200.00 :				
:				
A: :				
DELTA K B: :				
MAX C: :				
D: :				
:				

ROOT MEAN SQUARE   0.00
PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.440"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

IN100

Figure 5.8.3.5

5.8-19

TABLE 5.8.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.9 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=-1.00	R=-0.50		
DELTA K MIN	A:	13.48	1.08			
	B:	12.10		.532		
	C:					
	D:					
		13.00		1.88		
		16.00	1.91	4.13		
		20.00	4.11	7.09		
		25.00	11.0	15.9		
		30.00		42.5		
DELTA K MAX	A:	26.54	15.2			
	B:	31.05		43.9		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			6.68	15.29		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1	1	
	1.25-2.0			
	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: + 800° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.228- 0.298"
SPECIMEN WIDTH: 0.988- 1.000"
REFERENCES: PW002

Figure 5.8.3.9

5.8-51

TABLE 5.8.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.10 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=-1.00	R=-0.50		
DELTA K MIN	A: 19.84	:	37.8			
	B: 13.75	:		11.9		
	C:	:				
	D:	:				
	16.00	:		21.7		
	20.00	:	38.5	40.9		
	25.00	:	42.4	73.9		
	30.00	:	91.0	128.		
	35.00	:	132.			
	40.00	:	176.			
DELTA K MAX	A: 42.98	:	253.			
	B: 33.24	:		184.		
	C:	:				
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	4.79	9.03

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5 0.5-0.8 0.8-1.25 1.25-2.0 >2.0	1	1

CONDITION/HT
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH 169.: KSI
ULT STRENGTH 236.5 KSI
SPECIMEN THK   0.299-   0.309"
SPECIMEN WIDTH   0.995-   1.038"
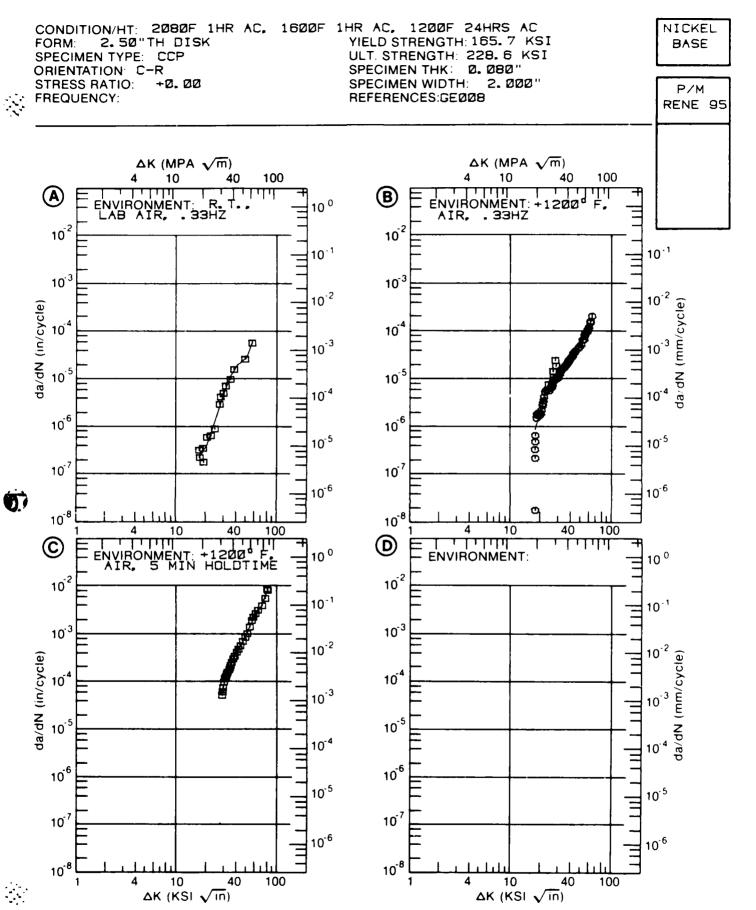REFERENCES PW002

Figure 5.8.3.10

TABLE 5.8.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.11 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.80			
DELTA K MIN	A:	5.60	2.78			
	B:					
	C:					
	D:					
		6.00	3.03			
		7.00	4.04			
		8.00	5.61			
		9.00	7.82			
		10.00	10.7			
		13.00	23.4			
DELTA K MAX	A:	13.74	27.2			
	B:					
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			9.23			

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1		
	1.25-2.0			
	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.302"
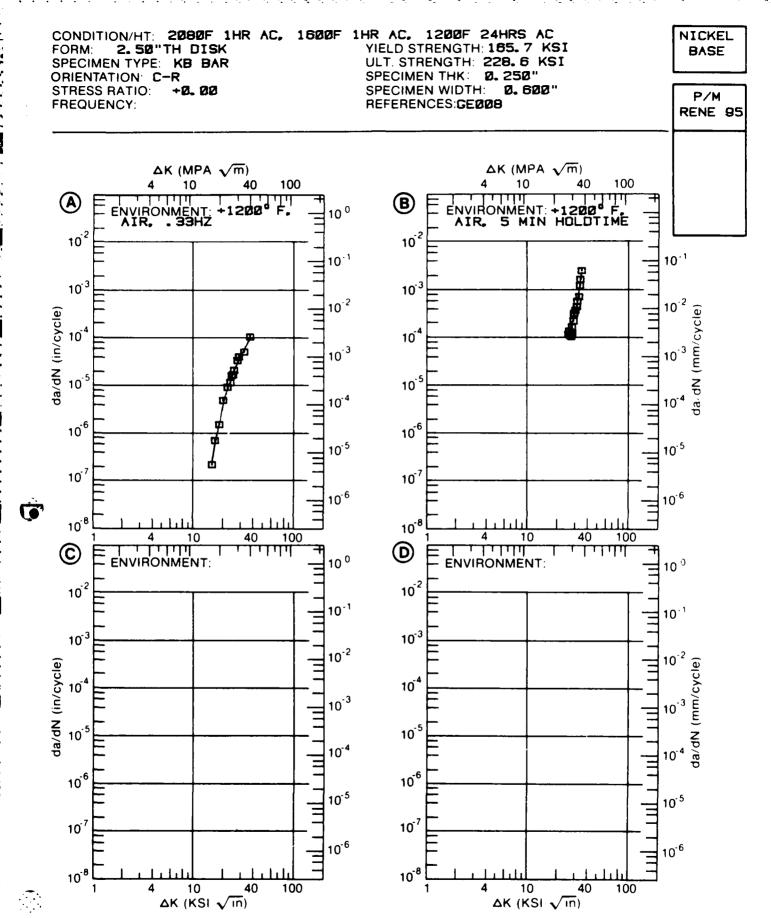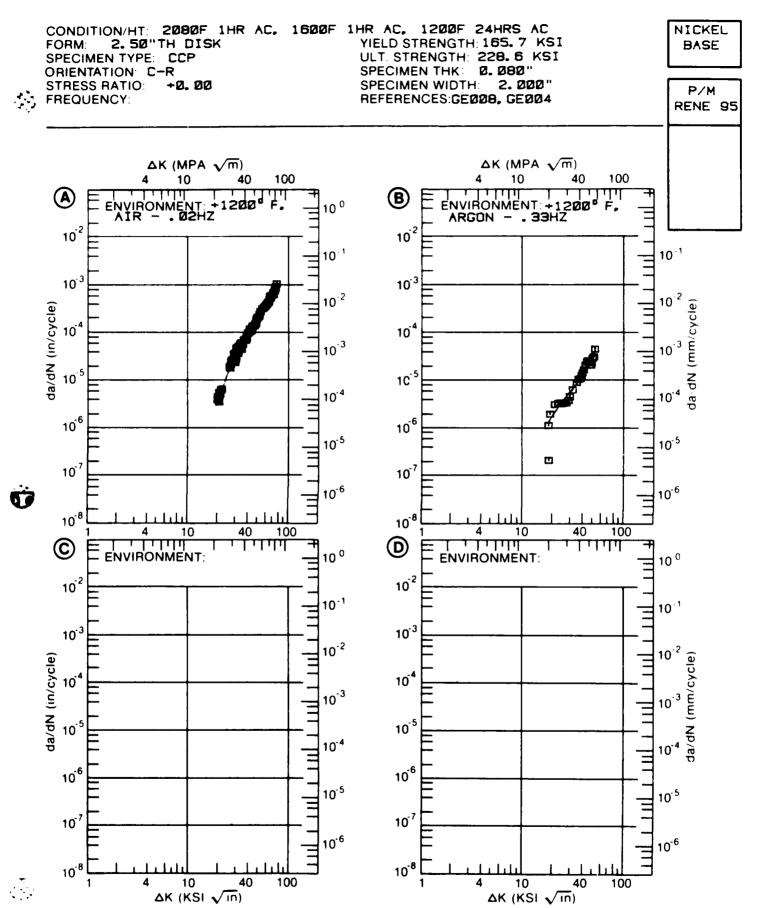SPECIMEN WIDTH: 2.503"
REFERENCES: PW002

Figure 5.8.3.11

TABLE 5.8.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
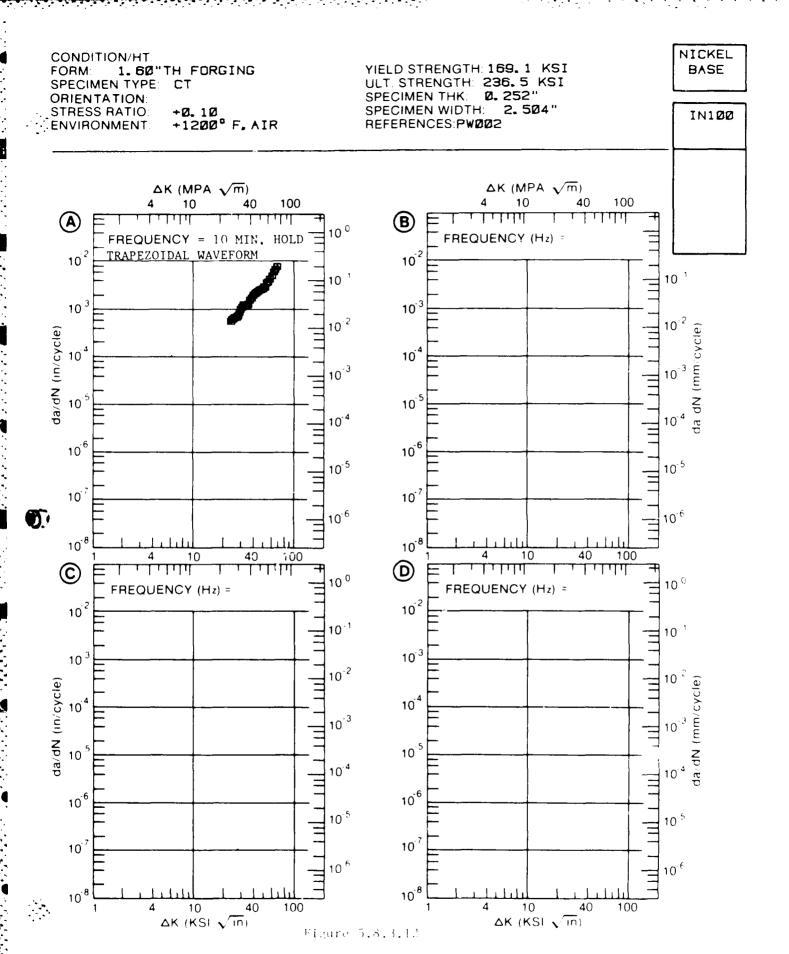
DATA ASSOCIATED WITH FIGURE 5.8.3.12 INDICATING EFFECT
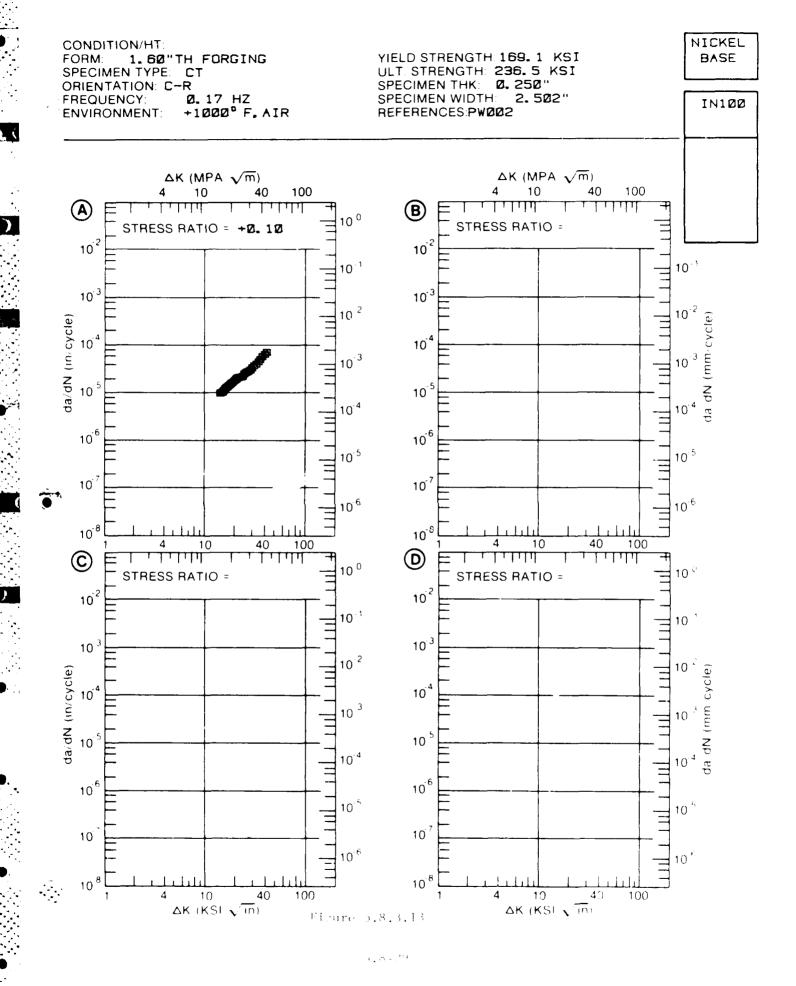
OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F=10 MIN HOLD TRAPEZOIDAL			
DELTA K MIN	A:	23.52	509.			
	B:					
	C:					
	D:					
		25.00	616.			
		30.00	1003.			
		35.00	1416.			
		40.00	1875.			
		50.00	3082.			
		60.00	5076.			
DELTA K MAX	A:	67.89	7719.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE   6.81
PERCENT ERROR

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
0.0-0.5		
0.5-0.8		
0.8-1.25	1	
1.25-2.0		
2.0		

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION:
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.252"
SPECIMEN WIDTH: 2.504"
REFERENCES:PW002

(A) FREQUENCY = 10 MIN. HOLD
TRAPEZOIDAL WAVEFORM

ΔK (MPA $\sqrt{m}$)

da/dN (in/cycle)

(B) FREQUENCY (Hz) =

ΔK (MPA $\sqrt{m}$)

da/dN (mm/cycle)

(C) FREQUENCY (Hz) =

da/dN (in/cycle)

ΔK (KSI $\sqrt{in}$)

(D) FREQUENCY (Hz) =

da/dN (mm/cycle)

ΔK (KSI $\sqrt{in}$)

Figure 5.8.3.12

5.8-27

TABLE 5.8.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.13   INDICATING EFFECT
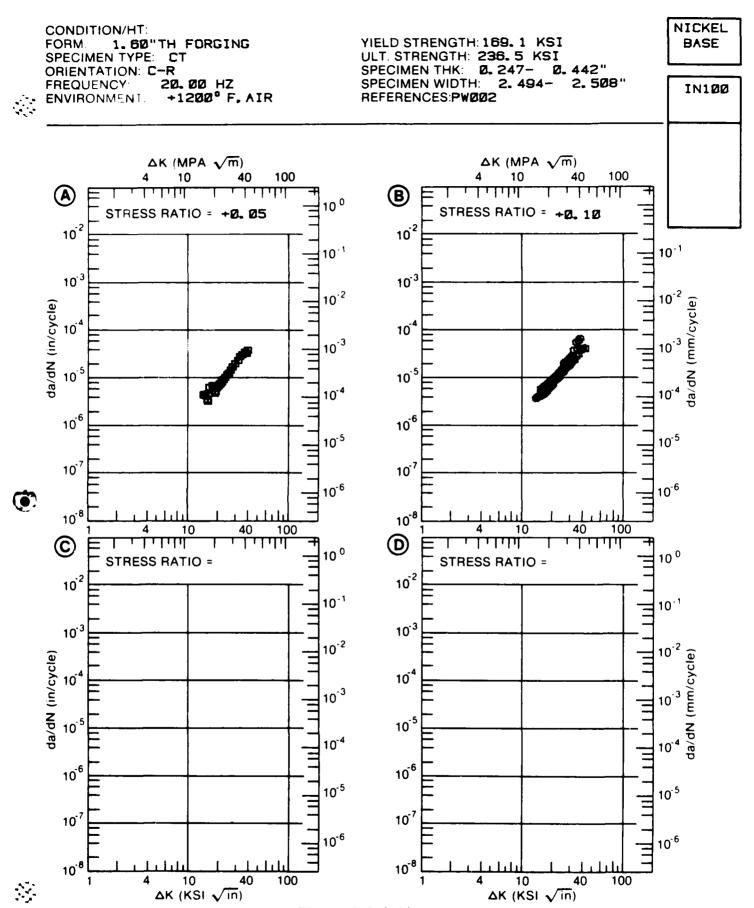
OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1000F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10			
DELTA K MIN	A:	14.22	9.13			
	B:					
	C:					
	D:					
		16.00	11.9			
		20.00	17.6			
		25.00	24.6			
		30.00	33.2			
		35.00	45.8			
		40.00	65.2			
DELTA K MAX	A:	41.33	72.1			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	2.53

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1000° F. AIR

YIELD STRENGTH:169.1 KSI
ULT.STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.502"
REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.8.3.13

TABLE 5.8.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.14 INDICATING EFFECT
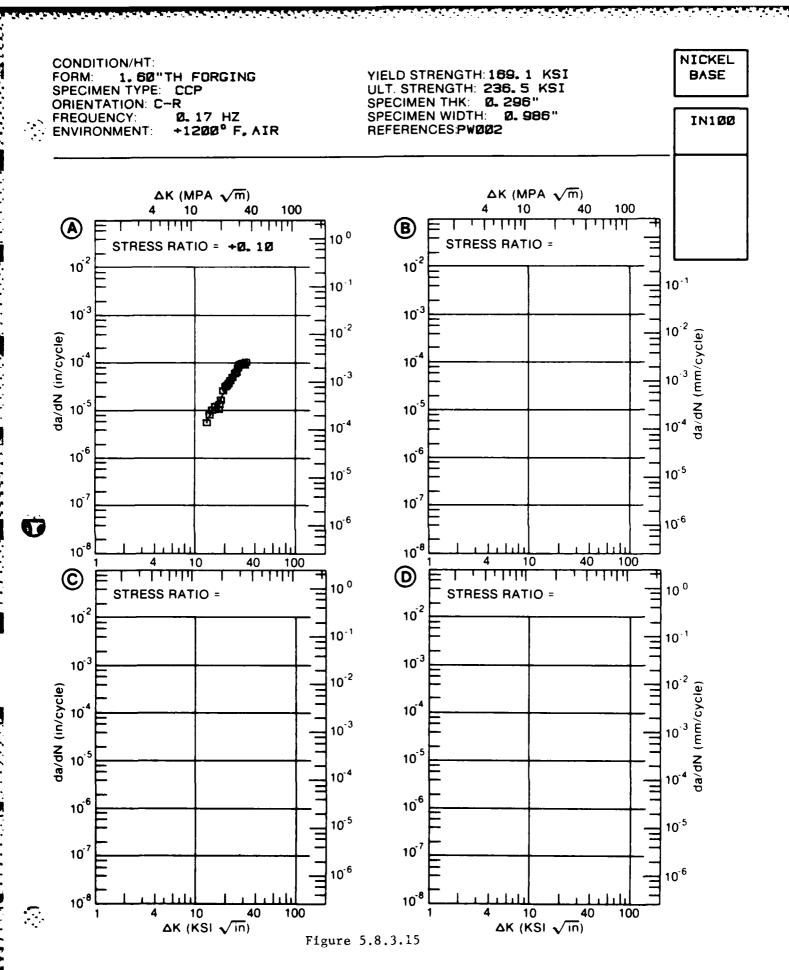
OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05	R=+0.10		
DELTA K MIN	A: 14.03	4.32			
	B: 13.55		3.94		
	C:				
	D:				
	16.00	4.75	4.92		
	20.00	7.10	8.16		
	25.00	12.6	15.2		
	30.00	20.9	25.3		
	35.00	30.8	36.6		
	40.00		46.6		
DELTA K MAX	A: 38.79	38.1			
	B: 41.45		49.0		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	12.71	17.34

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	2
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

CONDITION/HT:
FORM   1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY   20.00 HZ
ENVIRONMENT   +1200° F. AIR

YIELD STRENGTH:169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.247- 0.442"
SPECIMEN WIDTH: 2.494- 2.508"
REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.8.3.14

5.8-31

TABLE 5.8.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.15 INDICATING EFFECT
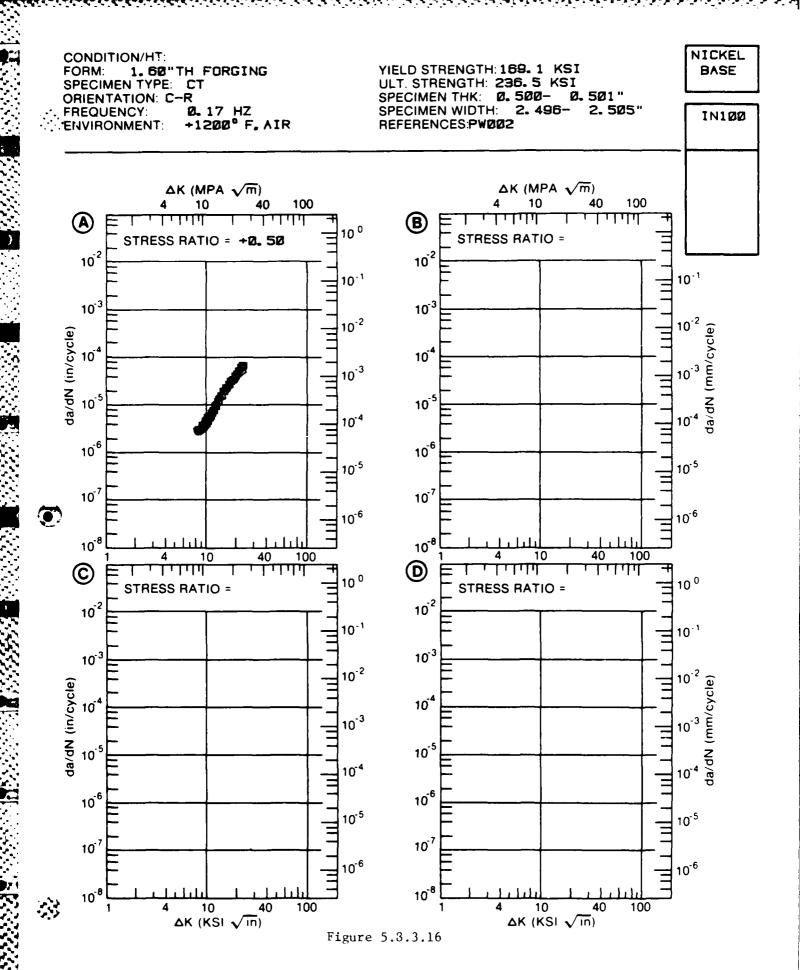
OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10			
A:	12.89	6.18			
DELTA K B:					
MIN C:					
D:					
	13.00	6.36			
	16.00	12.3			
	20.00	27.6			
	25.00	65.3			
	30.00	95.5			
A:	31.93	95.6			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	12.43

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH:169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.296"
SPECIMEN WIDTH: 0.986"
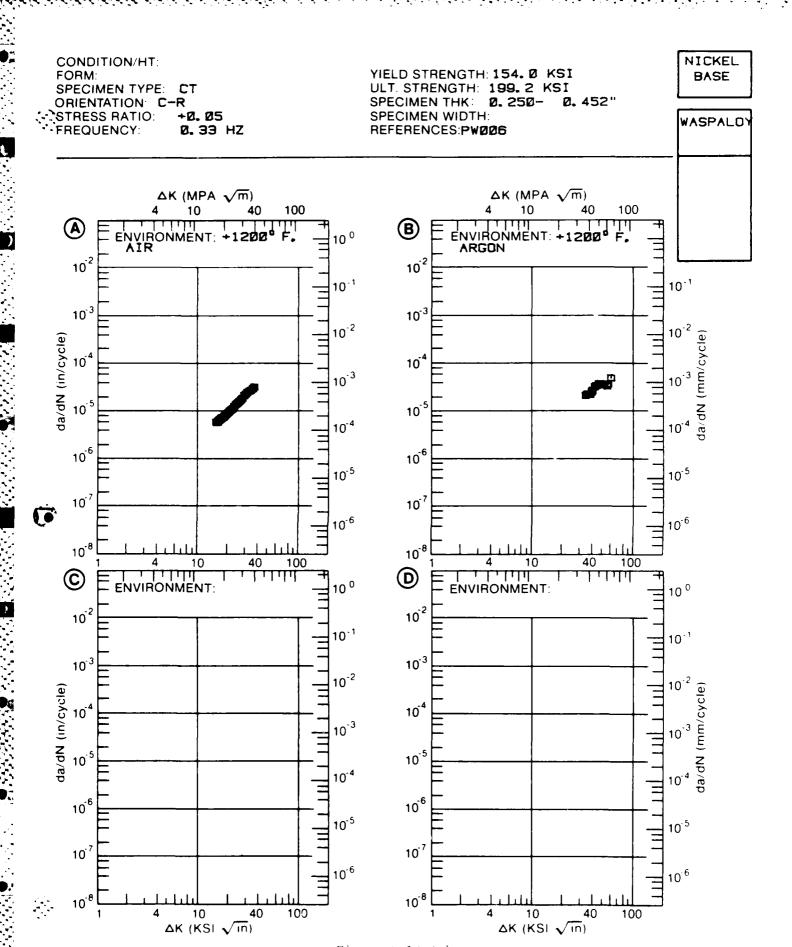REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.8.3.15

TABLE 5.8.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.16 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.50			
A: 8.06	:	2.41			
DELTA K B:	:				
MIN C:	:				
D:	:				
	:				
9.00	:	3.31			
10.00	:	4.63			
13.00	:	11.5			
16.00	:	23.4			
20.00	:	44.1			
A: 22.91	:	58.3			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	8.04

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

5.8-34

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.500- 0.501"
SPECIMEN WIDTH: 2.496- 2.505"
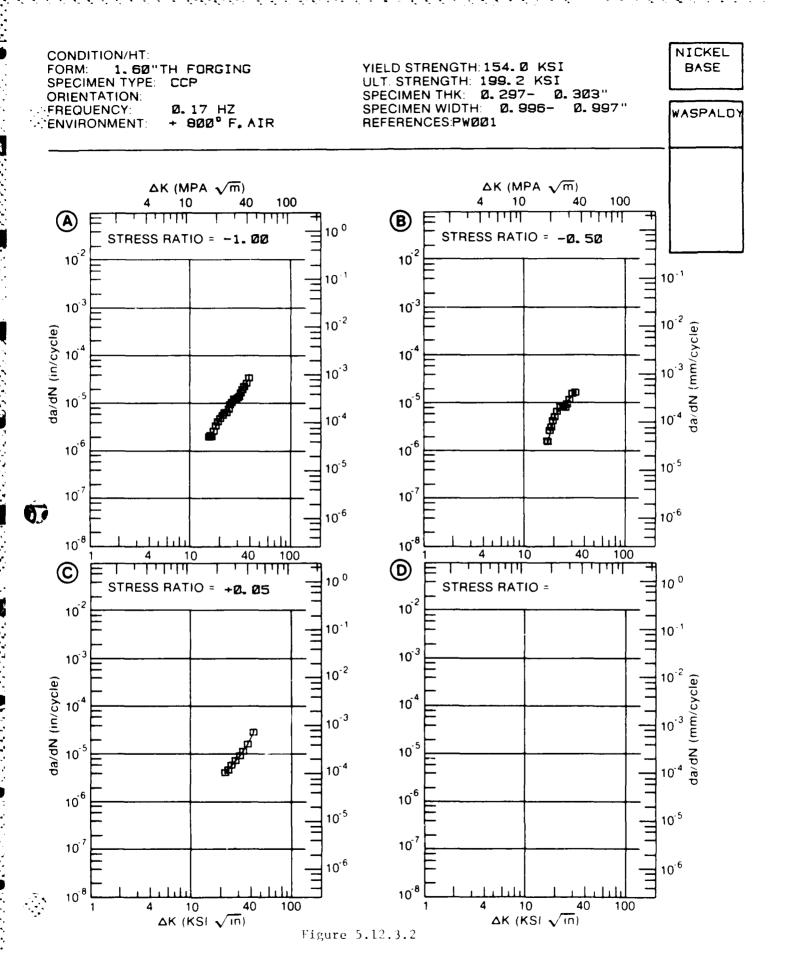REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.3.3.16

TABLE 5.8.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
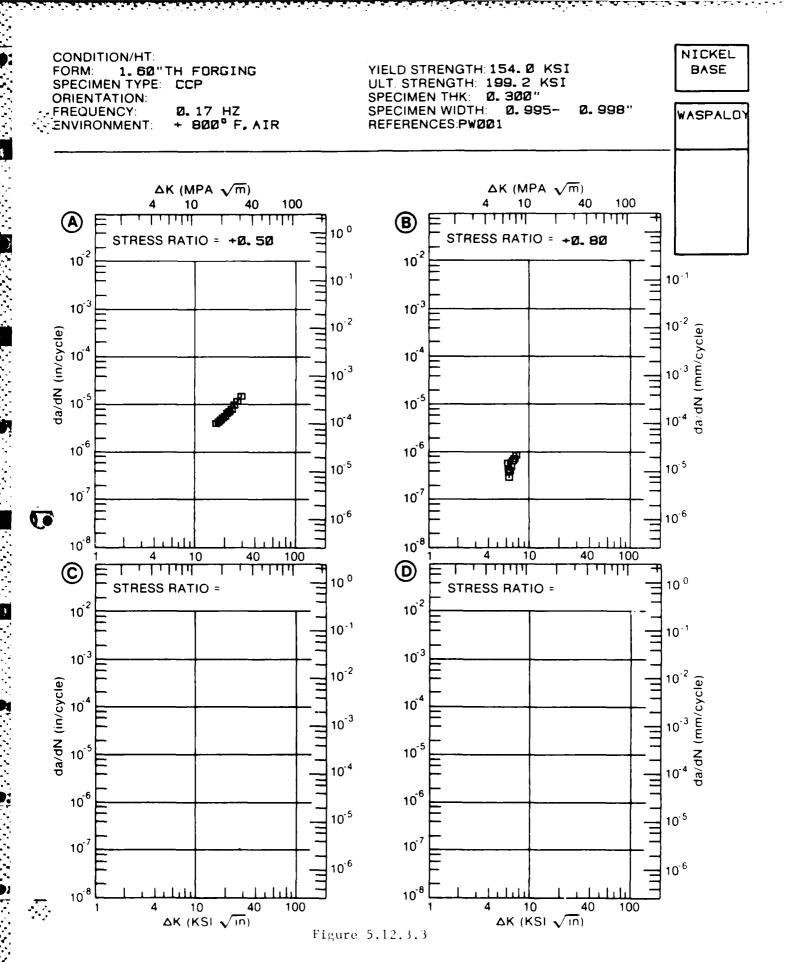
DATA ASSOCIATED WITH FIGURE 5.8.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   IN100
CONDITION:

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E=+1300F AIR, 0.17HZ	E=+1350F AIR, 0.01HZ	E=+1350F AIR, 0.17HZ	
A: 20.20	:	39.0			
DELTA K B: 27.86	:		281.		
MIN C: 14.68	:			16.2	
D:	:				
16.00	:			24.1	
20.00	:			53.3	
25.00	:	70.7		94.7	
30.00	:	110.	322.	145.	
35.00	:	153.	452.	216.	
40.00	:	197.	630.	329.	
50.00	:	280.	1117.		
60.00	:		1699.		
A: 54.45	:	313.			
DELTA K B: 65.70	:		2019.		
MAX C: 41.46	:			375.	
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	4.36	6.81	13.97	

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.253-   0.502"
SPECIMEN WIDTH: 2.498-   2.511"
REFERENCES: PW002

NICKEL
BASE

IN100

Figure 5.8.3.17

TABLE 5.8.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
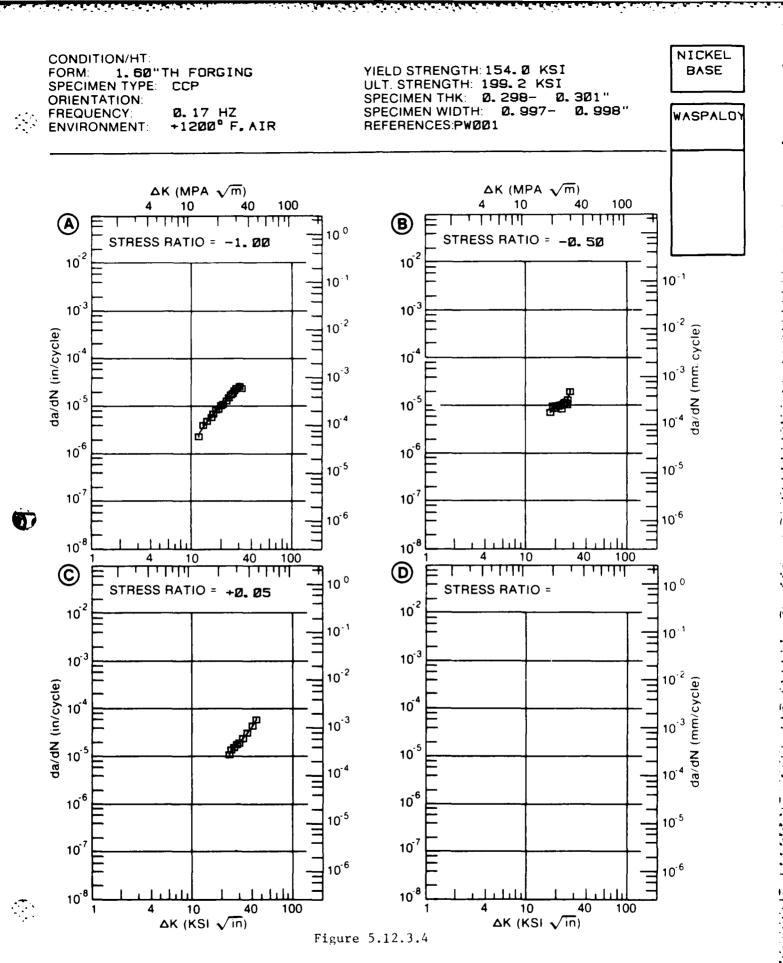
DATA ASSOCIATED WITH FIGURE 5.8.3.18 INDICATING EFFECT

OF FREQUENCY

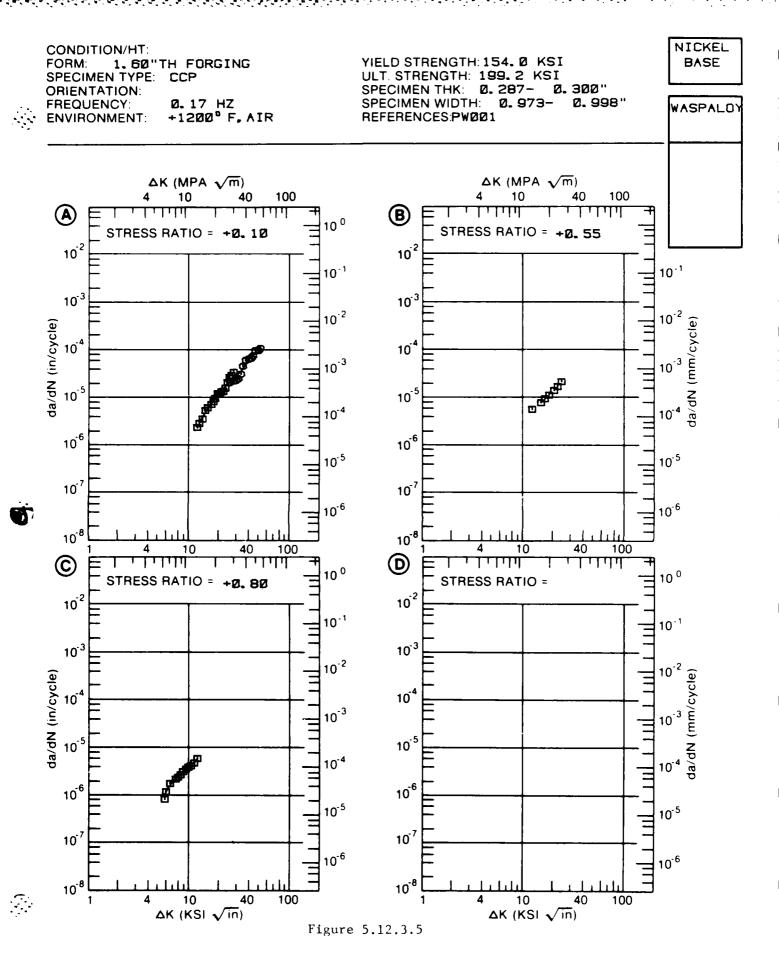MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.01	F(HZ)= 0.17	F(HZ)= 20.00	
A:	15.43	20.0			
DELTA K B:	13.17		7.25		
MIN C:	13.55			3.94	
D:					
	16.00	21.5	16.9	4.92	
	20.00	36.9	35.3	8.16	
	25.00	69.8	62.0	15.2	
	30.00	120.	90.0	25.3	
	35.00	188.	120.	36.6	
	40.00	274.	153.	46.6	
	50.00	492.	239.		
	60.00	745.			
	70.00	996.			
	80.00	1214.			
	90.00	1378.			
A:	91.39	1396.			
DELTA K B:	57.86		337.		
MAX C:	41.45			49.0	
D:					
ROOT MEAN SQUARE PERCENT ERROR		11.27	9.73	17.34	
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	3	5	2	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

5.8-38

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.247- 0.870"
SPECIMEN WIDTH: 2.437- 2.511"
REFERENCES: PW006

NICKEL
BASE

IN100

Figure 5.8.3.18

TABLE 5.8.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.19 INDICATING EFFECT

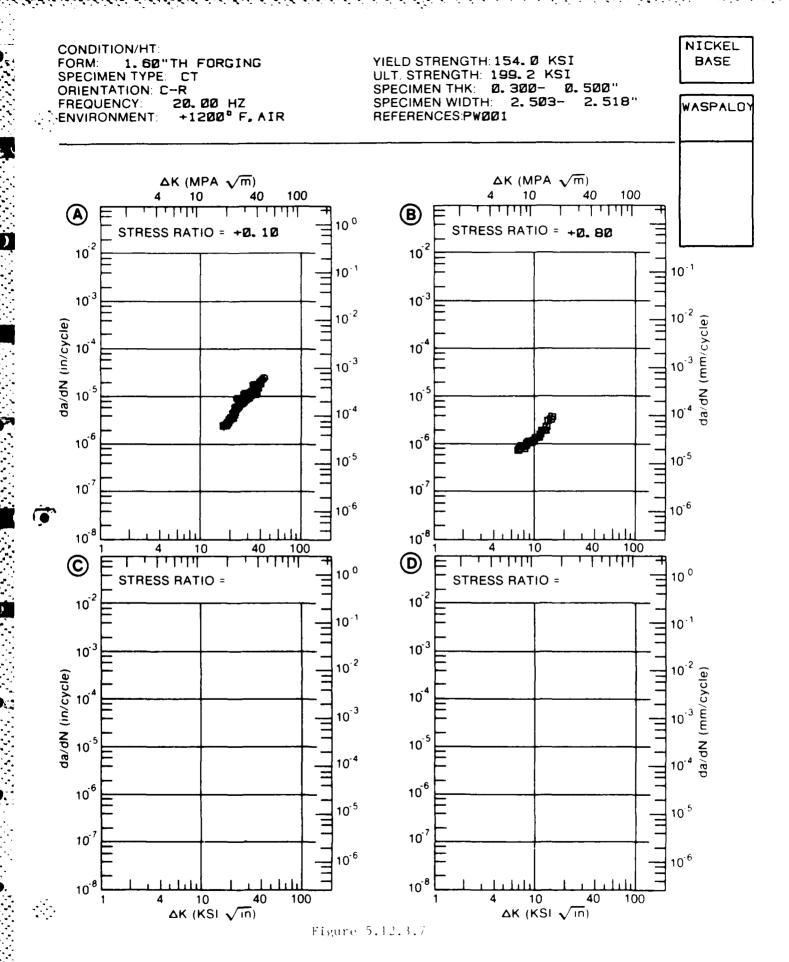### OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F=1 MIN HOLD TRAPEZOIDAL	F=2 MIN HOLD TRAPEZOIDAL	F=10 MIN HOLD TRAPEZOIDAL	F=20 MIN HOLD TRAPEZOIDAL
DELTA K MIN	A: 18.78	52.1			
	B: 15.61		89.6		
	C: 19.39			203.	
	D: 27.08				371.
	16.00		87.0		
	20.00	61.9	93.7	208.	
	25.00	144.	156.	347.	
	30.00	315.	279.	703.	587.
	35.00	559.	462.	1363.	1010.
	40.00	785.	679.	2332.	1466.
	50.00		1006.		2555.
	60.00				4304.
DELTA K MAX	A: 41.45	831.			
	B: 50.80		1018.		
	C: 49.73			4327.	
	D: 67.35				6558.
ROOT MEAN SQUARE PERCENT ERROR		6.62	15.60	7.60	10.08

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
	0.0-0.5				
	0.5-0.8				
	0.8-1.25	1	2	1	1
	1.25-2.0				
	>2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.250- 0.856"
SPECIMEN WIDTH: 2.436- 2.510"
REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.8.3.19

5.8-41

TABLE 5.8.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.20 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1350F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:				
	:	F=2 MIN HOLD			
	:	TRAPEZOIDAL			
	:				
A: 12.93	:	105.			
DELTA K B:	:				
MIN C:	:				
D:	:				
	:				
13.00	:	107.			
16.00	:	293.			
20.00	:	776.			
	:				
A: 21.29	:	871.			
DELTA K B:	:				
MAX C:	:				
D:	:				
	:				

ROOT MEAN SQUARE   13.50
   PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT:
FORM: 1.50"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1350° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.436"
SPECIMEN WIDTH: 2.495"
REFERENCES: PW002

Figure 5.8.3.20

TABLE 5.8.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.8.3.21 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   IN100
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.17	F(HZ)= 20.00		
DELTA K MIN	A:	9.28	17.5			
	B:	4.30		.367		
	C:					
	D:					
		5.00		.600		
		6.00		.977		
		7.00		1.32		
		8.00		1.68		
		9.00		2.11		
		10.00	19.5	2.69		
		13.00	31.8			
		16.00	55.2			
DELTA K MAX	A:	18.16	84.6			
	B:	11.78		4.46		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			6.15	6.64		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1	1	
	1.25-2.0			
	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.80
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.206-   0.503"
SPECIMEN WIDTH: 2.496-   2.498"
REFERENCES:PW002

Figure 5.8.3.21

TABLE 5.8.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE   INDICATING EFFECT

OF STRESS RATIO
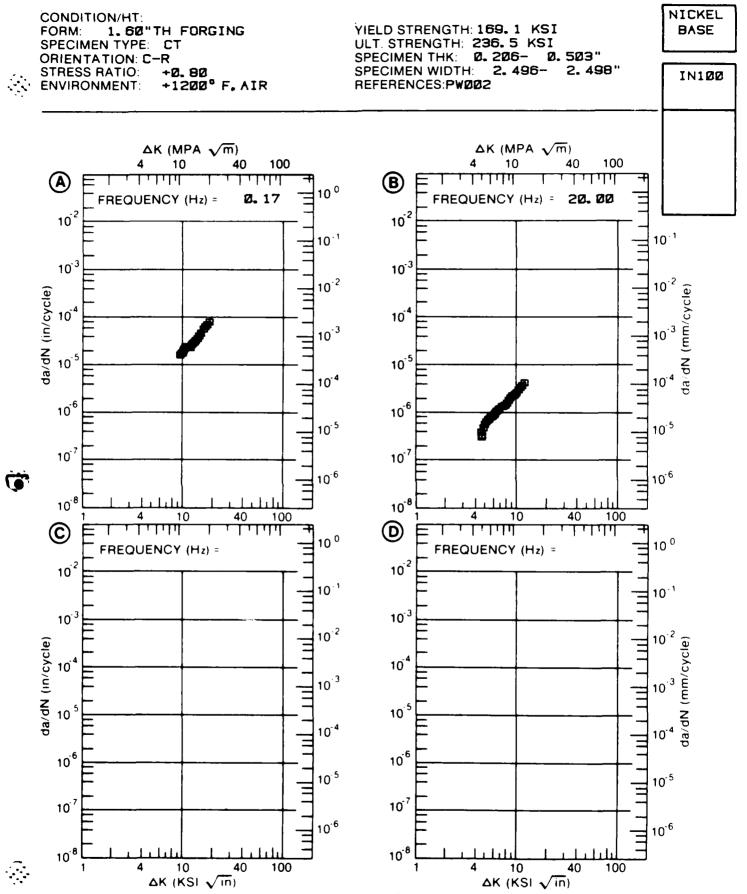
MATERIAL: NICKEL BASE   IN100
CONDITION: PRESTRAIN
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10			
A: 11.89		2.42			
DELTA K B:					
MIN C:					
D:					
13.00		4.10			
16.00		16.1			
A: 19.36		34.1			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE   33.86
   PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	
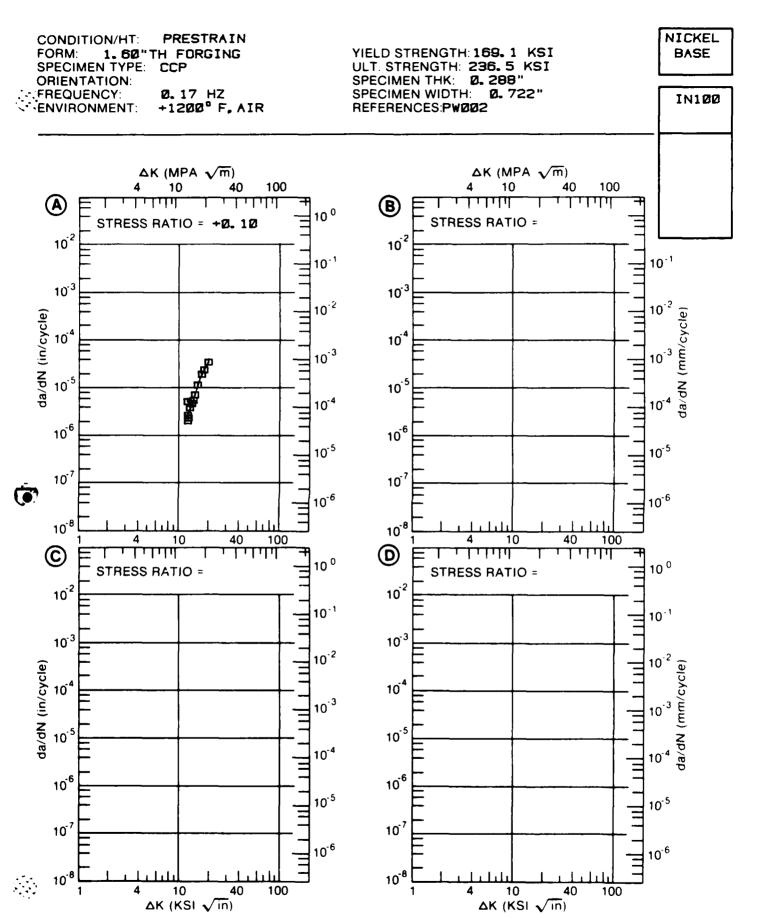
CONDITION/HT: PRESTRAIN
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 169.1 KSI
ULT. STRENGTH: 236.5 KSI
SPECIMEN THK: 0.288"
SPECIMEN WIDTH: 0.722"
REFERENCES:PW002

NICKEL
BASE

IN100

Figure 5.8.3.22

5.8-47

Table 5.9.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE IN100 P/M-C

TEST CONDITIONS

SPECIMEN
ORIENTATION   C-R

ENVIRONMENT: AIR
              AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)						
					2.5	5	10	20	50	100	
2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC,1400F 4HR AC	DISK	0.05	0.01					26.9			
2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC, 1400F 4HR AC	DISK	0.05	0.33					18.5			
2050F 2HR OQ, 1600F 67HR AC, 1200F 24HR AC,1400F 4HR AC	DISK	0.05	20.00					6.16			

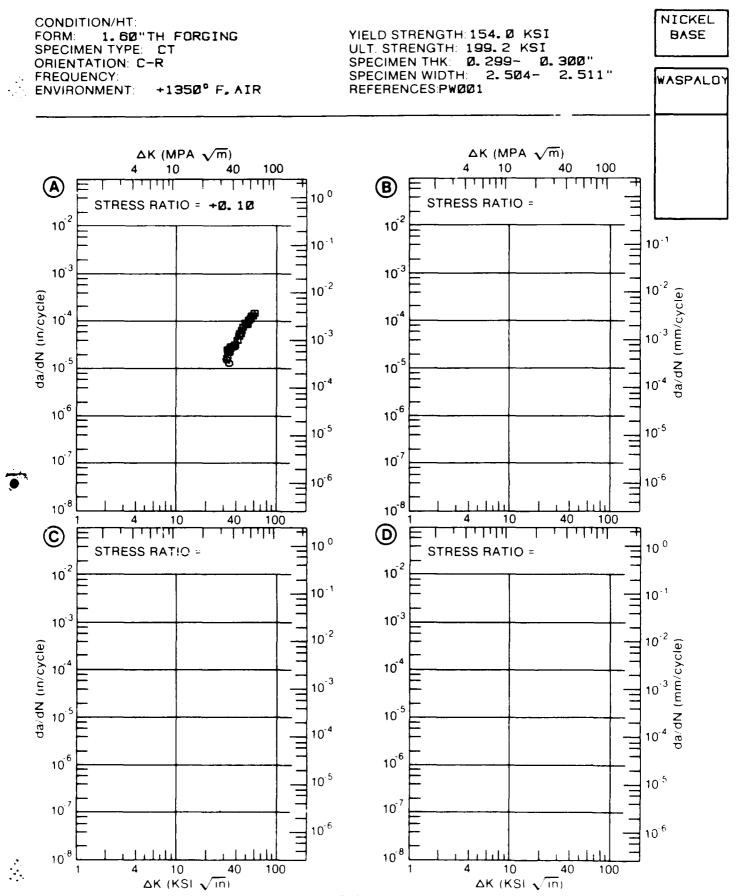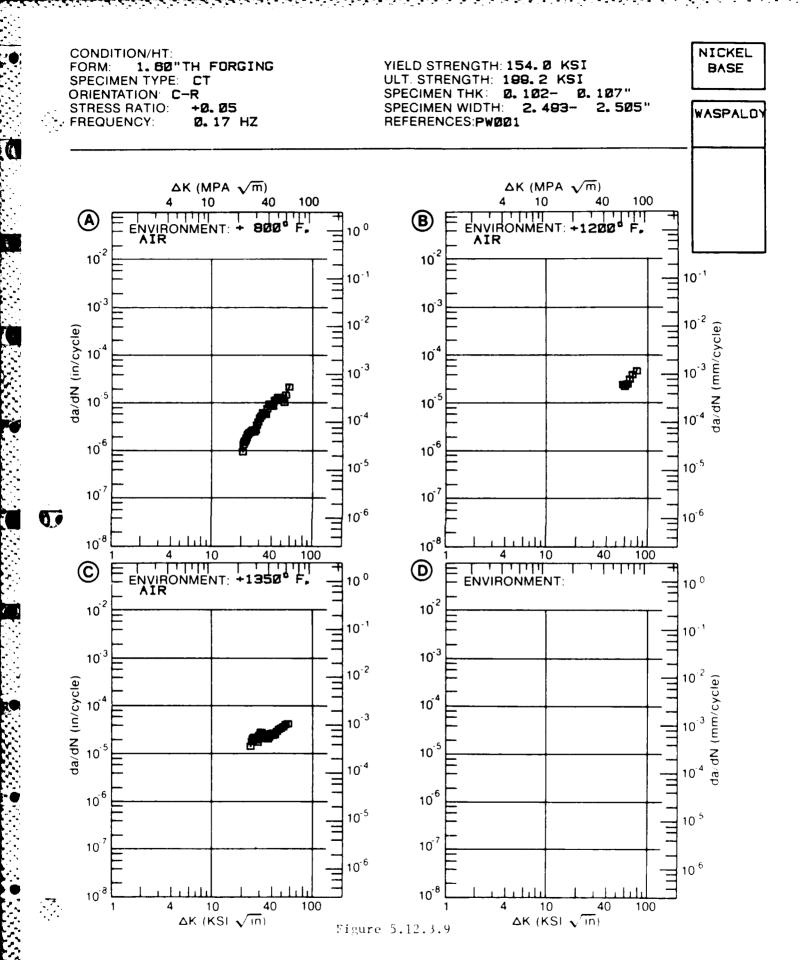TABLE 5.9.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
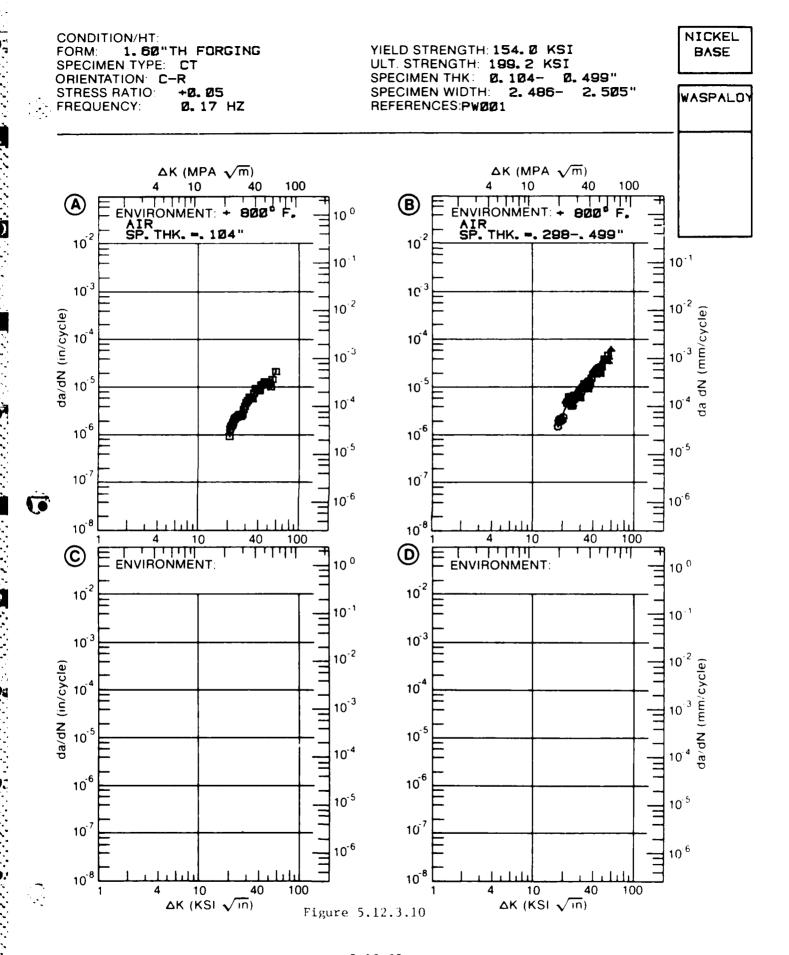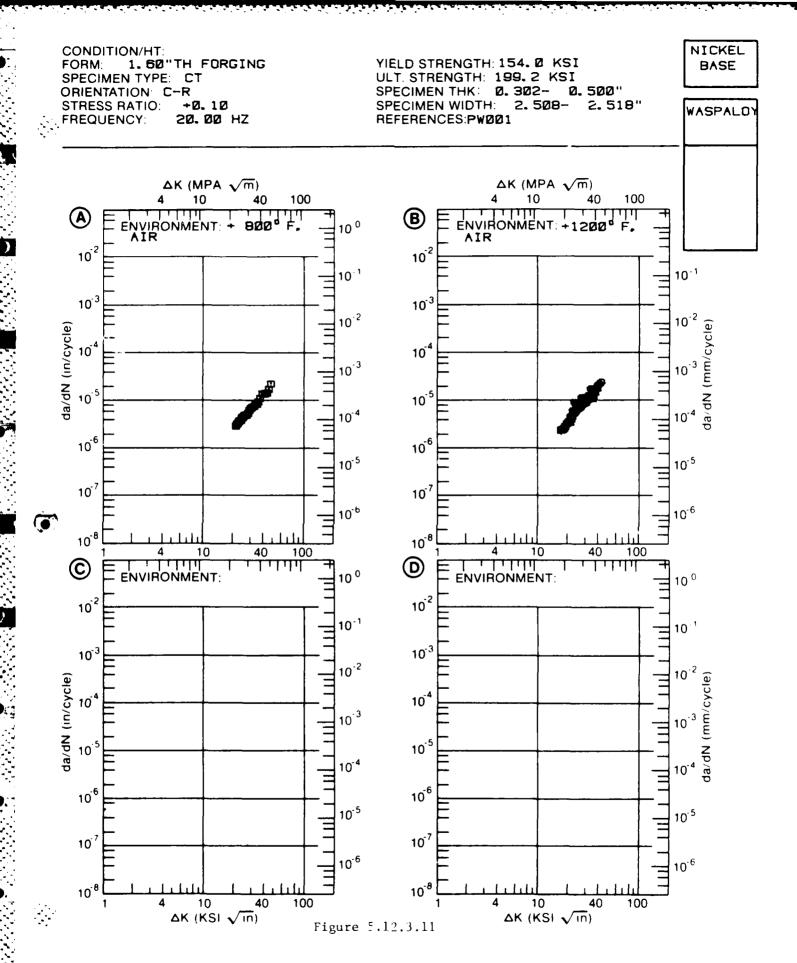
DATA ASSOCIATED WITH FIGURE 5.9.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   IN100 P/ M-G
CONDITION: 2050F 2HR OQ,1600F .67HR AC,1200F
           24HR AC,1400F 4HR AC

ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F=15 MIN HOLD TRAPEZOIDAL	F(HZ)= 0.01	F(HZ)= 0.33	F(HZ)= 20.00
DELTA K MIN	A: 24.49	463.			
	B: 13.36		7.57		
	C: 13.44			2.78	
	D: 15.92				4.25
	16.00		9.13	7.49	4.27
	20.00		26.9	18.5	6.16
	25.00	485.	58.6	34.1	10.6
	30.00	773.	87.5	49.2	17.4
	35.00	1226.	114.	64.3	26.2
	40.00	1915.	157.	81.4	35.9
	50.00	4412.			
	60.00	9530.			
	70.00	19994.			
	80.00	40505.			
	90.00	63096.			
DELTA K MAX	A: 97.60	64557.			
	B: 43.75		214.		
	C: 46.90			112.	
	D: 46.70				47.6
ROOT MEAN SQUARE PERCENT ERROR		31.42	15.26	17.71	24.67

LIFE   0.0-0.5
PREDICTION   0.5-0.8
 RATIO   0.8-1.25
 SUMMARY   1.25-2.0
 (NP/NA)   >2.0

CONDITION/HT: 2050F 2HR OQ, 1600F .67HR AC, 1200F
24HR AC, 1400F 4HR AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 158.2 KSI
ULT. STRENGTH: 176.9 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL
BASE

IN100
P/M-G

Figure 5.9.3.1

5.9-3

Table 5.10.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE NASA IIB-7 P/M

TEST CONDITIONS

SPECIMEN ORIENTATION: C-R

ENVIRONMENT: AIR AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1650F 16HRS TO 2000F 1HR DQ, 1400F 16HRS AC	DISK	0.05	15 MIN. HOLDTIME TRAPEZOIDAL WAVEFORM					3592		
1650F 16HRS TO 2000F 1HR DQ, 1400F 16HRS AC	DISK	0.05	0.33					15.8	313	

5.10-1

TABLE 5.10.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.10.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   NASA IIB -7 P/M
CONDITION: 1650F 16HRS TO 2000F 1HR OQ, 1400F 16HRS AC
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:				
	:	F=15 MIN HOLD F(HZ)= 0.33			
	:	TRAPEZOIDAL			
	:				
A: 13.30	:	315.			
DELTA K B: 14.67	:		4.87		
MIN C:	:				
D:	:				
	:				
16.00	:	1303.	5.96		
20.00	:	3593.	15.8		
25.00	:	6526.	35.6		
30.00	:	10084.	60.3		
35.00	:	16495.	92.6		
40.00	:	30610.	137.		
50.00	:		313.		
	:				
A: 45.79	:	74742.			
DELTA K B: 51.24	:		483.		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	70.69	16.34		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1650F 16HRS TO 2000F 1HR OQ. 1400F 16HRS AC
FORM: 1.75"TH DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 208.6 KSI
ULT. STRENGTH: 257.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

NASA IIB-7 P/M

(A) FREQUENCY = 15 MIN.
TRAPEZOIDAL HOLD

(B) FREQUENCY (Hz) = 0.33

(C) FREQUENCY (Hz) =

(D) FREQUENCY (Hz) =

Figure 5.10.3.1

Table 5.11.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE P/M RENE 95

TEST CONDITIONS

ENVIRONMENT: AIR AT 1200 F

SPECIMEN ORIENTATION C-R

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))					FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)
				2.5	5	10	20	50	100
2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC	DISK	0.00	0.33				2.61	54.1	
2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC	DISK	0.00	0.02				4.03	200	

TABLE 5.11.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.1 INDICATING EFFECT

OF ENVIRONMENT


MATERIAL: NICKEL BASE   RENE 95   (H&F)
CONDITION: 2000F 1HR, SQ   AT 1000F, 1400F 16HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F : AIR			

		DELTA K	:	A
	A:	13.58 :		2.15
DELTA K	B:	:		
MIN	C:	:		
	D:	:		

	16.00 :	4.38
	20.00 :	10.4
	25.00 :	17.9
	30.00 :	29.6
	35.00 :	49.8
	40.00 :	85.6

			:	
	A:	45.70 :		141.
DELTA K	B:	:		
MAX	C:	:		
	D:	:		

ROOT MEAN SQUARE PERCENT ERROR	16.33

LIFE	0.0-0 5
PREDICTION	0.5-0 8
RATIO	0.8-1 25
SUMMARY	1.25-2 0
(NP/NA)	>2.0

CONDITION/HT: 2000F 1HR, SQ AT 1000F, 1400F 16HRS
FORM: 1.23"TH FORGING   YIELD STRENGTH:171.0 KSI
SPECIMEN TYPE: KB BAR   ULT. STRENGTH:
ORIENTATION: C-R   SPECIMEN THK: 0.250"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 0.600"
FREQUENCY: 0.33 HZ   REFERENCES:GE001

Figure 5.11.3.1

TABLE 5.11.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   P/M RENE   95
CONDITION: 2080F 1HR AC,   1600F 1HR AC, 1200F 24HRS AC

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. LAB AIR, .33HZ	E=+1200F AIR, .33HZ	E=+1200F AIR, 5 MIN HOLD	
DELTA K MIN	A:	16.68	.216			
	B:	17.22		.840		
	C:	28.18			59.5	
	D:					
		20.00	.394	2.61		
		25.00	1.60	7.87		
		30.00	5.29	13.8	103.	
		35.00	11.8	19.9	250.	
		40.00	18.9	27.2	413.	
		50.00	27.6	54.1	1093.	
		60.00		132.	2403.	
		70.00			4006.	
		80.00			8368.	
DELTA K MAX	A:	56.41	55.2			
	B:	63.62		192.		
	C:	80.21			8535.	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			24.24	27.95	7.78	

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC

FORM: 2.50"TH DISK   YIELD STRENGTH: 165.7 KSI
SPECIMEN TYPE: CCP   ULT. STRENGTH: 228.6 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.080"
STRESS RATIO: +0.00   SPECIMEN WIDTH: 2.000"
FREQUENCY: REFERENCES: GE008
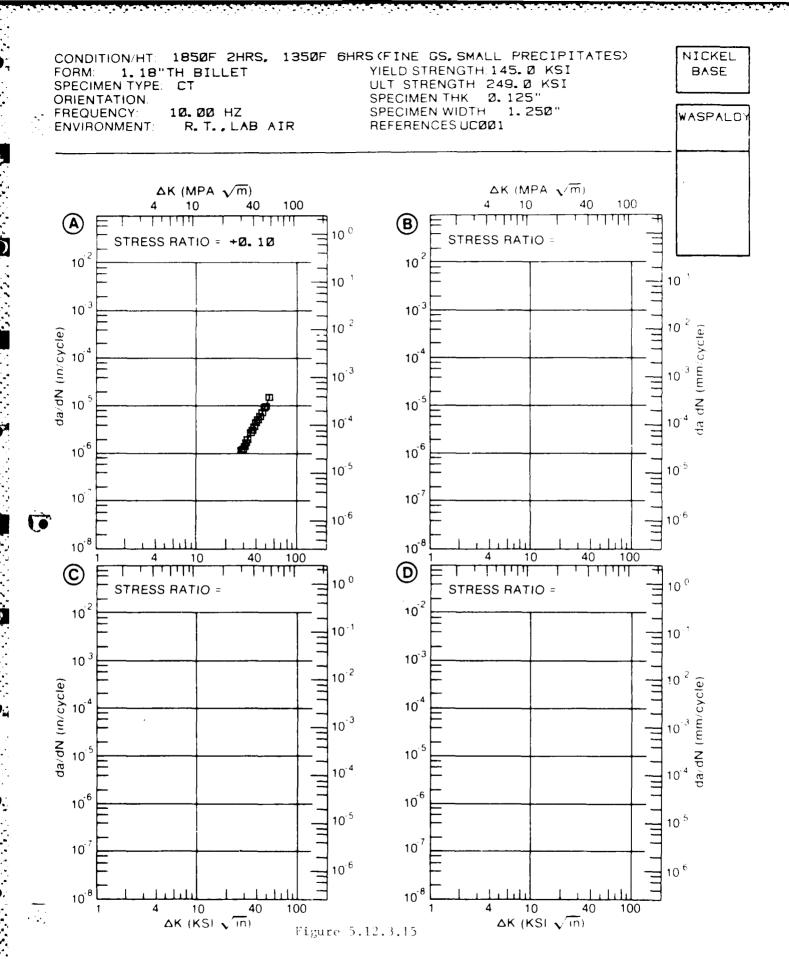
NICKEL
BASE

P/M
RENE 95

Figure 5.11.3.2

5.11-5

TABLE 5.11.3.3
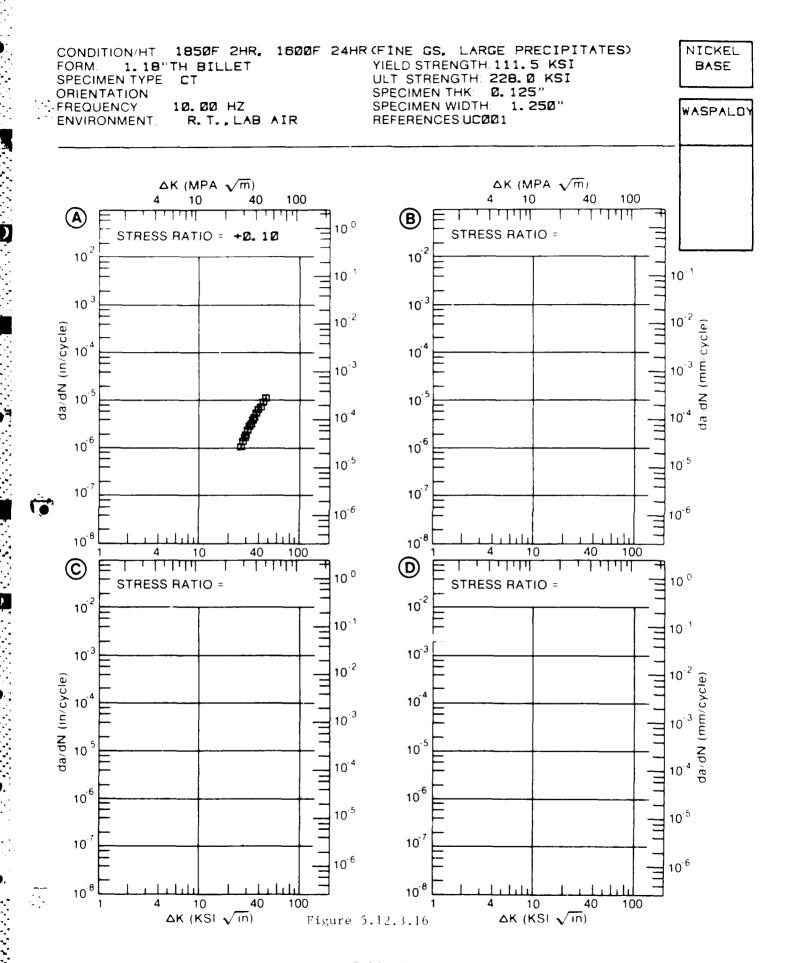
FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   P/M RENE   95
CONDITION: 2080F 1HR AC,   1600F 1HR AC, 1200F 24HRS AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F AIR, .33HZ	E=+1200F AIR, 5 MIN HOLD		
DELTA K MIN	A: 15.06	.236			
	B: 24.98		107.		
	C:				
	D:				
	16.00	.531			
	20.00	5.00			
	25.00	20.1	107.		
	30.00	44.5	406.		
	35.00	82.4			
DELTA K MAX	A: 36.31	96.2			
	B: 33.95		2226.		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		15.59	28.98		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
  RATIO   0.8-1.25
  SUMMARY   1.25-2.0
  (NP/NA)   >2.0

CONDITION/HT: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC
FORM: 2.50"TH DISK   YIELD STRENGTH: 165.7 KSI
SPECIMEN TYPE: KB BAR   ULT. STRENGTH: 228.6 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.250"
STRESS RATIO: +0.00   SPECIMEN WIDTH: 0.600"
FREQUENCY: REFERENCES:GE008

NICKEL
BASE

P/M
RENE 95

Figure 5.11.3.3

TABLE 5.11.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.4 INDICATING EFFECT

OF ENVIRONMENT
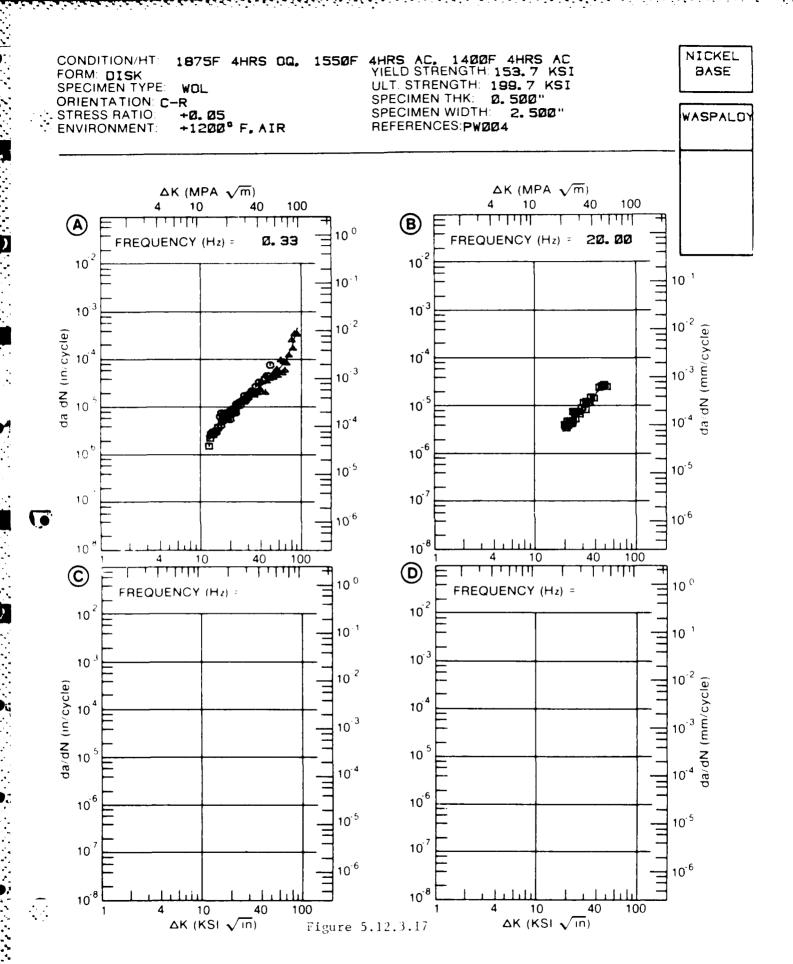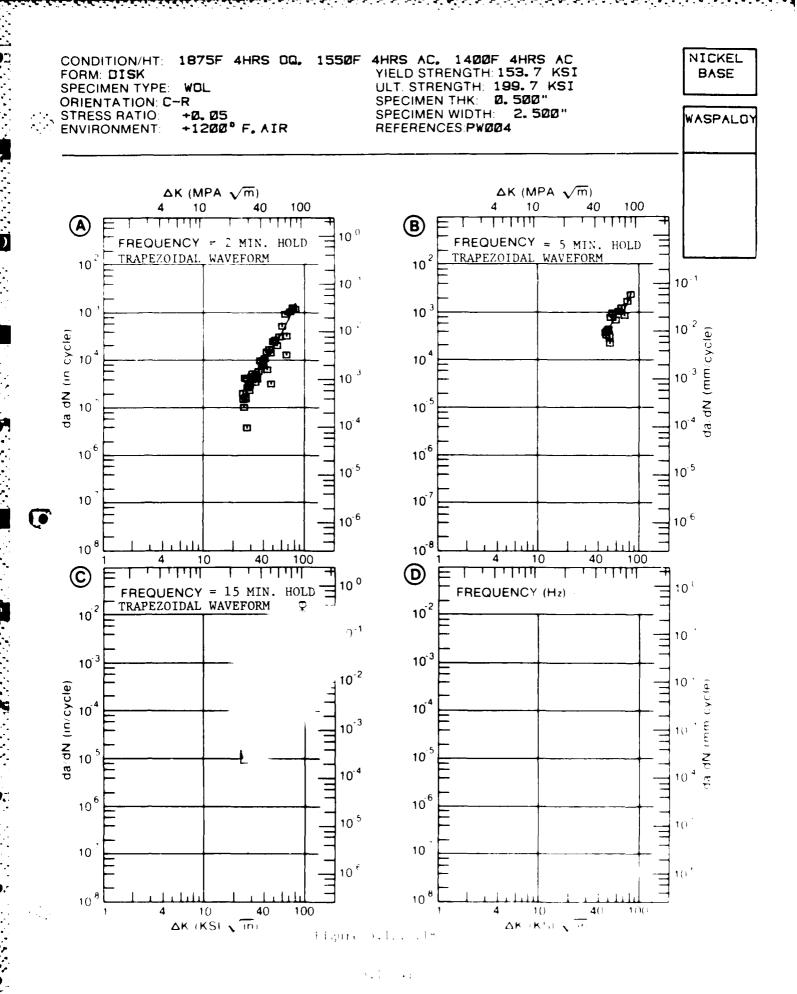

MATERIAL: NICKEL BASE   P/M RENE   95
CONDITION: 2080F 1HR AC,   1600F 1HR AC, 1200F 24HRS AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F AIR - .02HZ	E=+1200F ARGON - .33HZ		
A: 19.55	:	3.45			
DELTA K B: 17.82	:		1.29		
MIN C:	:				
D:	:				
20.00	:	4.03	1.94		
25.00	:	14.8	3.71		
30.00	:	33.9	5.95		
35.00	:	61.3	9.11		
40.00	:	97.0	14.0		
50.00	:	200.	35.3		
60.00	:	369.			
70.00	:	662.			
A: 76.15	:	948.			
DELTA K B: 51.58	:		41.3		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	11.36	24.59

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 2080F 1HR AC, 1600F 1HR AC, 1200F 24HRS AC
FORM: 2.50"TH DISK
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.00
FREQUENCY:

YIELD STRENGTH: 165.7 KSI
ULT. STRENGTH: 228.6 KSI
SPECIMEN THK: 0.080"
SPECIMEN WIDTH: 2.000"
REFERENCES: GE008, GE004

NICKEL
BASE

P/M
RENE 95

Figure 5.11.3.4

TABLE 5.11.3.5
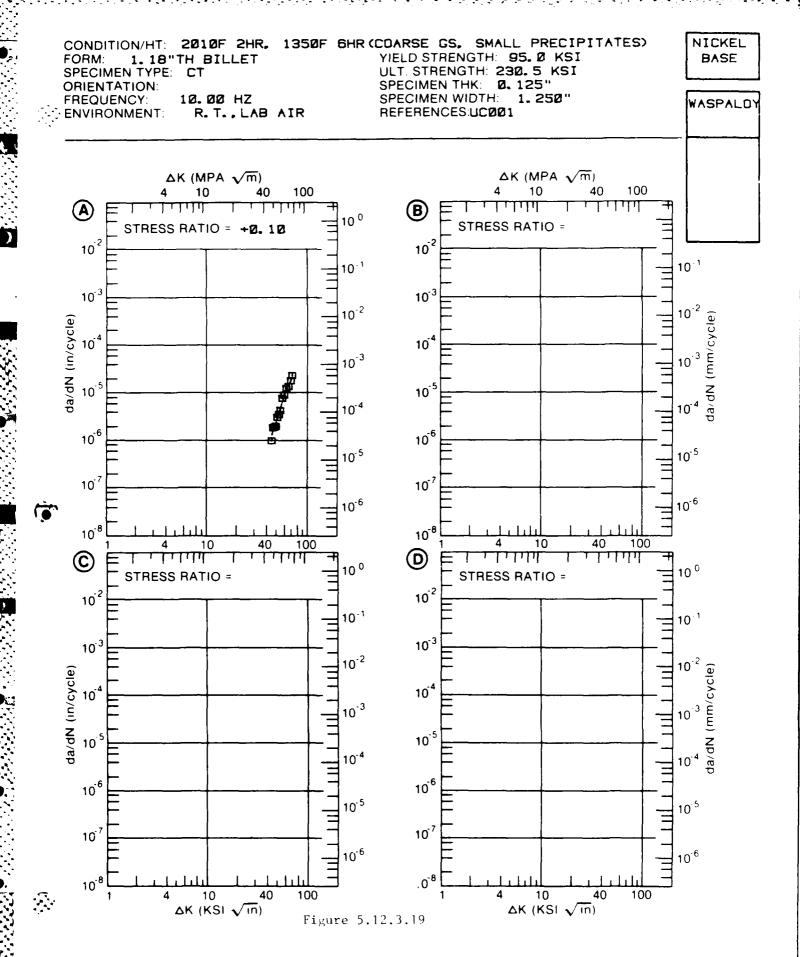
FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.11.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   P/M RENE   95
CONDITION: 2100F 1HR, SG AT 1000F, 1600F 1HR, 1200F 24HRS, AC

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E=+1200F : AIR			
A: 12.70	:	2.95			
DELTA K B:	:				
MIN C:	:				
D:	:				
	:				
13.00	:	3.24			
16.00	:	6.16			
20.00	:	9.97			
25.00	:	17.0			
30.00	:	31.2			
35.00	:	58.7			
40.00	:	110.			
50.00	:	179.			
A: 56.60	:	708.			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   24.46
PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 2100F 1HR. SQ AT 1000F 1600F 1HR. 1200F 24HRS. AC
FORM: 1.00"TH DISK   YIELD STRENGTH: 176.1 KSI
SPECIMEN TYPE: KB BAR   ULT. STRENGTH:
ORIENTATION: C-R   SPECIMEN THK: 0.250"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 0.600"
FREQUENCY: 0.33 HZ   REFERENCES: GE001

NICKEL
BASE

P/M
RENE 95

Figure 5.11.3.5

5.11-11

Table 5.12.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN
ORIENTATION: Unknown

ENVIRONMENT: LAB AIR
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))						FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)
				2.5	5	10	20	50	100	
1850F 2HRS, 1330F 6HRS(FINE GS, SMALL PRECIPITATES)	BILLET	0.10	10.00					10.7		
2010F 2HR, 1330F 4HR(COARSE GS, SMALL PRECIPITATES)	BILLET	0.10	10.00					2.84		
2010F 2HR, 1600F 24HR(COARSE GS, LARGE PRECIPITATES)	BILLET	0.10	10.00					9.65		

Table 5.12.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN
ORIENTATION Unknown

ENVIRONMENT: AIR
AT 800 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)			
				2.5	5	10	20	50	100
	FORGING	-1.00	0.17				4.87		
	FORGING	-0.50	0.17				5.56		
	FORGING	0.50	0.17				5.93		

Table 5.12.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN
ORIENTATION Unknown

ENVIRONMENT: AIR
AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
FORGING	FORGING	-1.00	0.17				10.8		
FORGING	FORGING	-0.50	0.17				9.57		
FORGING	FORGING	0.10	0.17				12.4	95.8	
FORGING	FORGING	0.80	0.17			3.84			

5.12-3

Table 5.12.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

NICKEL-BASE WASPALOY

TEST CONDITIONS

SPECIMEN
ORIENTATION   C-R

ENVIRONMENT: AIR
AT 1200 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
	FORGING	0.05	0.17					8.79		
	FORGING	0.05	0.33						49.5	
	FORGING	0.05	20.00					4.36		
	FORGING	0.10	0.17					10.4		
	FORGING	0.10	20.00					3.78		
	FORGING	0.10	20.00					3.71		
	FORGING	0.10	20.00					3.98		
	FORGING	0.80	20.00				1.28			
1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC	DISK	0.05	0.33					8.34	44.6	
1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4HRS AC	DISK	0.05	20.00					3.86	29.7	

5.12-4

TABLE 5.12.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+1200F AIR	E=+1200F ARGON		
A: 14.91		5.71			
DELTA K B: 33.32			18.2		
MIN C:					
D:					
16.00		6.28			
20.00		9.44			
25.00		15.3			
30.00		22.6			
35.00		29.8	21.9		
40.00			29.8		
50.00			35.3		
A: 35.87		31.0			
DELTA K B: 59.56			42.8		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		2.05	9.70		

LIFE   0.0-0.5
PREDICTION 0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.33 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.250- 0.452"
SPECIMEN WIDTH:
REFERENCES: PW006

NICKEL BASE

WASPALOY

Figure 5.12.3.1

TABLE 5.12.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.2INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=-1.00	R=-0.50	R=+0.05	
	A:	15.16	1.67			
DELTA K	B:	16.44		1.37		
MIN	C:	21.55			3.81	
	D:					
		16.00	2.16			
		20.00	4.87	5.56		
		25.00	8.78	9.24	5.56	
		30.00	14.1	14.5	8.66	
		35.00	23.3		13.7	
		40.00			23.2	
	A:	37.90	32.1			
DELTA K	B:	31.61		18.5		
MAX	C:	41.48			27.5	
	D:					

ROOT MEAN SQUARE PERCENT ERROR	7.42	9.14	2.64

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING   YIELD STRENGTH: 154.0 KSI
SPECIMEN TYPE: CCP   ULT. STRENGTH: 199.2 KSI
ORIENTATION: SPECIMEN THK: 0.297- 0.303"
FREQUENCY: 0.17 HZ   SPECIMEN WIDTH: 0.996- 0.997"
ENVIRONMENT: + 800° F. AIR   REFERENCES: PW001

Figure 5.12.3.2

TABLE 5.12.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: + 800F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.50	R=+0.80		
A: 15.92	:	3.93			
DELTA K B: 6.02	:		.434		
MIN C:	:				
D:	:				
7.00	:		.765		
8.00	:				
9.00	:				
10.00	:				
13.00	:				
16.00	:	3.96			
20.00	:	5.93			
25.00	:	10.3			
A: 28.39	:	14.8			
DELTA K B: 7.32	:		.791		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	2.90	22.36		

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	1
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

Figure 5.12.3.3

TABLE 5.12.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=-1.00	R=-0.50	R=+0.05	
DELTA K MIN	A:	11.63	2.52			
	B:	17.29		7.33		
	C:	23.34			11.6	
	D:					
		13.00	3.66			
		16.00	6.50			
		20.00	10.8	9.57		
		25.00	17.1	11.4	13.6	
		30.00	25.5		20.4	
		35.00			29.8	
		40.00			44.8	
DELTA K MAX	A:	31.47	28.5			
	B:	27.24		18.7		
	C:	43.07			58.7	
	D:					

ROOT MEAN SQUARE PERCENT ERROR	6.60	9.76	3.65	

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1	1	1
	1.25-2.0			
	>2.0			

5.12-12

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.298- 0.301"
SPECIMEN WIDTH: 0.997- 0.998"
REFERENCES: PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.4

TABLE 5.12.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.13.3.5 INDICATING EFFECT
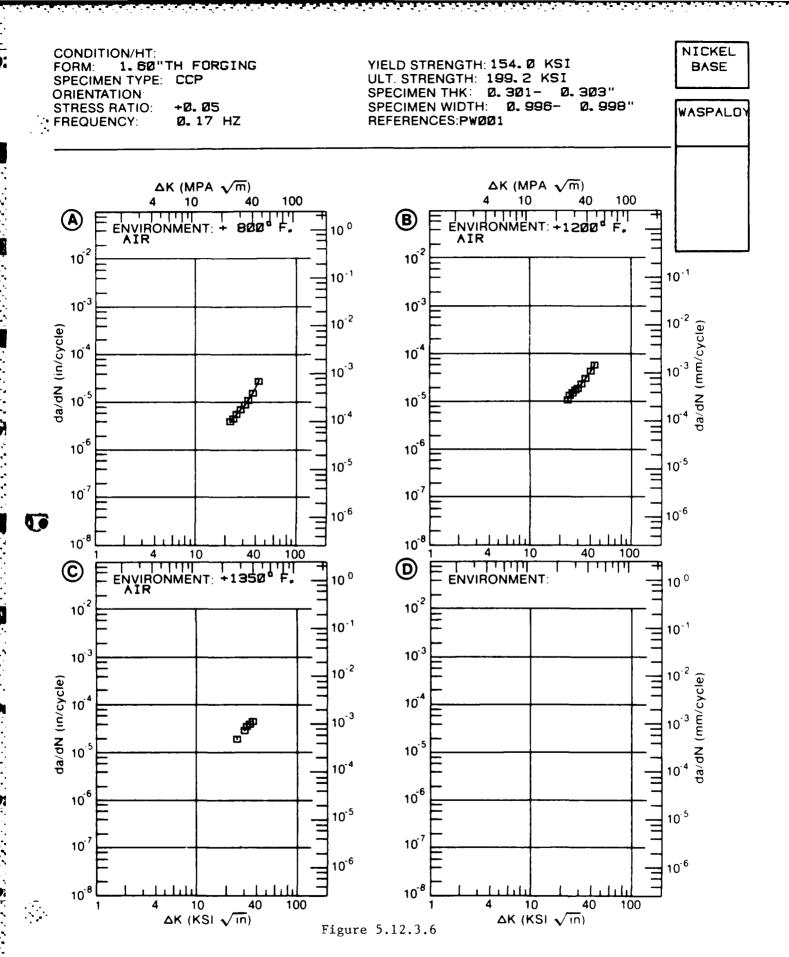
OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.55	R=+0.80	
DELTA K MIN A: 11.83		2.23			
DELTA K MIN B:					
DELTA K MIN C: 5.59				.994	
DELTA K MIN D:					
6.00				1.33	
7.00				2.07	
8.00				2.68	
9.00				3.22	
10.00				3.84	
13.00		3.36			
16.00		6.69			
20.00		12.4			
25.00		20.4			
30.00		28.4			
35.00		42.4			
40.00		66.1			
50.00		95.8			
DELTA K MAX A: 51.07		94.1			
DELTA K MAX B:					
DELTA K MAX C: 11.87				5.72	
DELTA K MAX D:					

ROOT MEAN SQUARE PERCENT ERROR	13.15	0.00	7.13	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	2		1	
1.25-2.0				
>2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 0.17 HZ
ENVIRONMENT: +1200° F, AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.287-   0.300"
SPECIMEN WIDTH: 0.973-   0.998"
REFERENCES:PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.5

5.12-15

TABLE 5.12.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 800F :AIR	E=+1200F AIR	E=+1350F AIR	
DELTA K MIN A:	21.55 :	3.81			
DELTA K MIN B:	23.34 :		11.6		
DELTA K MIN C:					
DELTA K MIN D:					
	25.00 :	5.56	13.6		
	30.00 :	8.66	20.4		
	35.00 :	13.7	29.8		
	40.00 :	23.2	44.8		
DELTA K MAX A:	41.48 :	27.5			
DELTA K MAX B:	43.07 :		58.7		
DELTA K MAX C:					
DELTA K MAX D:					
ROOT MEAN SQUARE PERCENT ERROR		2.64	3.65	0.00	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.301- 0.303"
SPECIMEN WIDTH: 0.996- 0.998"
REFERENCES: PW001

Figure 5.12.3.6

TABLE 5.12.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	R=+0.10	R=+0.80		
DELTA K MIN A: 16.66	1.93			
DELTA K MIN B: 6.75		.761		
DELTA K MIN C:				
DELTA K MIN D:				
7.00		.801		
8.00		.947		
9.00		1.10		
10.00		1.28		
13.00		2.43		
16.00				
20.00	3.98			
25.00	7.43			
30.00	11.0			
35.00	15.1			
40.00	20.4			
DELTA K MAX A: 42.08	23.2			
DELTA K MAX B: 14.64		3.92		
DELTA K MAX C:				
DELTA K MAX D:				
ROOT MEAN SQUARE PERCENT ERROR	14.93	7.70		
LIFE 0.0-0.5				
PREDICTION 0.5-0.8				
RATIO 0.8-1.25	2	1		
SUMMARY 1.25-2.0				
(NP/NA) >2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
FREQUENCY: 20.00 HZ
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH:154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.300- 0.500"
SPECIMEN WIDTH: 2.503- 2.518"
REFERENCES:PW001

Figure 5.12.3.7

TABLE 5.12.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.8 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1350F, AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.10			
A: 31.69	:	19.0			
DELTA K B:	:				
MIN C:	:				
D:	:				
35.00	:	24.5			
40.00	:	39.1			
50.00	:	89.5			
60.00	:	138.			
A: 60.02	:	138.			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   11.96
  PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT:
FORM: 1.60"TH FORGING   YIELD STRENGTH: 154.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 199.2 KSI
ORIENTATION: C-R   SPECIMEN THK: 0.299- 0.300"
FREQUENCY: SPECIMEN WIDTH: 2.504- 2.511"
ENVIRONMENT: +1350° F. AIR   REFERENCES: PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.8

5.12-21

TABLE 5.12.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:

DELTA K (KSI*IN**1/2)		:	DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	E=+ 800F AIR	E=+1200F AIR	E=+1350F AIR	
DELTA K MIN	A: 19.79	:	1.24			
	B:	:				
	C: 23.76	:			17.5	
	D:	:				
	20.00	:	1.29			
	25.00	:	2.69		19.0	
	30.00	:	4.53		22.5	
	35.00	:	7.38		24.1	
	40.00	:	10.3		25.8	
	50.00	:	11.8		34.3	
DELTA K MAX	A: 57.73	:	21.1			
	B:	:				
	C: 56.57	:			47.4	
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	11.40	0.00	10.70	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1		1
	1.25-2.0			
	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.102-   0.107"
SPECIMEN WIDTH: 2.493-   2.505"
REFERENCES: PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.9

TABLE 5.12.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 800F AIR SP.THK.=.104"	E=+ 800F AIR SP.THK.=.298-.499"		
DELTA K MIN	A: 19.79	1.24			
	B: 17.25		1.46		
	C:				
	D:				
	20.00	1.29	3.33		
	25.00	2.69	6.27		
	30.00	4.53	9.39		
	35.00	7.40	13.3		
	40.00	10.3	19.0		
	50.00	11.8	33.1		
DELTA K MAX	A: 57.73	20.9			
	B: 58.47		59.7		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	11.38	17.47		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	3	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
FREQUENCY: 0.17 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.104- 0.499"
SPECIMEN WIDTH: 2.486- 2.505"
REFERENCES:PW001

Figure 5.12.3.10

TABLE 5.12.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=+ 800F :AIR	E=+1200F AIR		
A:	20.94	2.96			
DELTA K B:	16.66		1.93		
MIN C:					
D:					
	20.00		3.98		
	25.00	4.45	7.43		
	30.00	6.72	11.0		
	35.00	9.60	15.1		
	40.00	13.3	20.4		
A:	46.62	19.9			
DELTA K B:	42.08		23.2		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		5.52	14.93		

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	2		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.10
FREQUENCY: 20.00 HZ

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.302- 0.500"
SPECIMEN WIDTH: 2.508- 2.518"
REFERENCES: PW001

NICKEL BASE

WASPALOY

Figure 5.12.3.11

TABLE 5.12.2.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.12 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.17	F(HZ)= 0.33	F(HZ)= 20.00	
A: 17.60		6.23			
DELTA K B: 29.22			17.0		
MIN C: 18.78				3.64	
D:					
20.00		8.79		4.36	
25.00		13.4		7.38	
30.00		19.4	18.6	10.6	
35.00		31.4	27.4	14.6	
40.00			34.3	19.9	
50.00			49.5		
60.00			82.0		
70.00			169.		
A: 37.21		40.8			
DELTA K B: 76.26			299.		
MAX C: 44.85				27.2	
D:					

ROOT MEAN SQUARE PERCENT ERROR		5.03	8.60	4.94	

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	2	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT:
FORM: 1.50"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.432-   0.753"
SPECIMEN WIDTH: 2.502- 2.519"
REFERENCES:PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.12

TABLE 5.12.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.13 INDICATING EFFECT
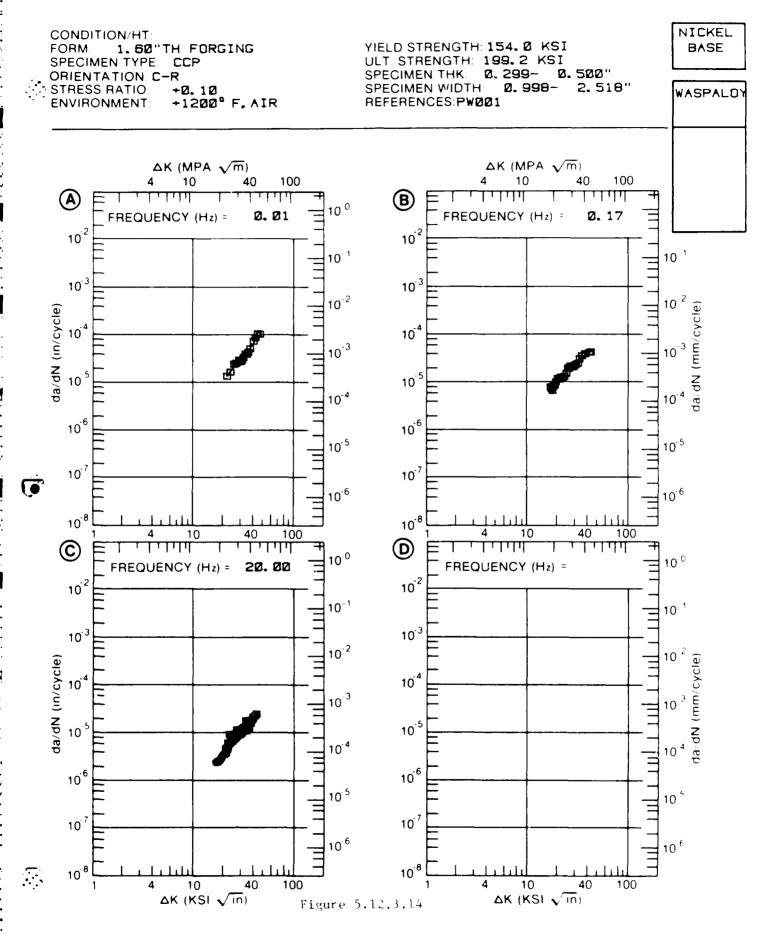
OF FREQUENCY

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= F=2 MIN HOLD TRAPEZOIDAL	F(HZ)= F=5 MIN HOLD TRAPEZOIDAL	F(HZ)= F=15 MIN HOLD TRAPEZOIDAL	
DELTA K MIN	A: 23.74	19.1			
	B: 44.65		172.		
	C: 23.65			17.2	
	D:				
	25.00	21.8		25.1	
	30.00	39.5		71.8	
	35.00	63.4		145.	
	40.00	96.5		245.	
	50.00	215.	477.	563.	
	60.00	491.	861.	1195.	
	70.00		1259.	2595.	
	80.00			5946.	
DELTA K MAX	A: 67.17	544.			
	B: 78.46		2633.		
	C: 84.43			8749.	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		12.50	10.08	14.05	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	1	1	3	
1.25-2.0				
>2.0				

CONDITION/HT:
FORM: 1.60"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.316- 0.422"
SPECIMEN WIDTH: 2.504- 2.509"
REFERENCES: PW001

NICKEL
BASE

WASPALOY

Figure 5.12.3.13

5.12-31

TABLE 5.12.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.14 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   WASPALOY
CONDITION:
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.01	F(HZ)= 0.17	F(HZ)= 20.00	
	A:	21.41	13.6			
DELTA K B:		16.71		7.03		
MIN C:		16.66			2.24	
	D:					
		20.00		10.4	3.71	
		25.00	20.9	17.1	7.90	
		30.00	31.4	25.1	11.1	
		35.00	45.6	33.6	14.2	
		40.00	69.5	41.5	20.9	
	A:	45.95	127.			
DELTA K B:		42.17		44.6		
MAX C:		42.08			26.1	
	D:					

ROOT MEAN SQUARE PERCENT ERROR	8.12	8.21	13.97

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	2
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT:
FORM   1.60"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: C-R
STRESS RATIO: +0.10
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 154.0 KSI
ULT. STRENGTH: 199.2 KSI
SPECIMEN THK: 0.299- 0.500"
SPECIMEN WIDTH: 0.998- 2.518"
REFERENCES: PW001

Figure 5.12.3.14

TABLE 5.12.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.15INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 1850F 2HRS, 1350F 6HRS(FINE GS, SMALL PRECIPITATES)
ENVIRONMENT: R.T., LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10			
DELTA K MIN	A: 27.75	1.09			
	B:				
	C:				
	D:				
	30.00	1.38			
	35.00	2.76			
	40.00	4.58			
	50.00	10.7			
DELTA K MAX	A: 53.11	14.5			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	4.51

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT: 1850F 2HRS, 1350F 6HRS (FINE GS, SMALL PRECIPITATES)
FORM: 1.18"TH BILLET   YIELD STRENGTH: 145.0 KSI
SPECIMEN TYPE: CT   ULT STRENGTH 249.0 KSI
ORIENTATION: SPECIMEN THK   0.125"
FREQUENCY: 10.00 HZ   SPECIMEN WIDTH   1.250"
ENVIRONMENT: R. T., LAB AIR   REFERENCES UC001

NICKEL BASE

WASPALOY

Figure 5.12.3.15

TABLE 5.12.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.16 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 1850F 2HR, 1600F 24HR(FINE GS, LARGE PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.10			
A: 25.47	:	1.02			
DELTA K B:	:				
MIN C:	:				
D:	:				
30.00	:	2.33			
35.00	:	4.39			
40.00	:	7.12			
A: 45.09	:	10.8			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	3.40

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT. 1850F 2HR. 1600F 24HR (FINE GS. LARGE PRECIPITATES)

FORM. 1.18"TH BILLET

SPECIMEN TYPE. CT

ORIENTATION:

FREQUENCY 10.00 HZ

ENVIRONMENT. R.T., LAB AIR

YIELD STRENGTH. 111.5 KSI

ULT. STRENGTH. 228.0 KSI

SPECIMEN THK 0.125"

SPECIMEN WIDTH. 1.250"

REFERENCES: UC001

NICKEL BASE

WASPALOY

Figure 5.12.3.16

TABLE 5.12.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 1875F 4HRS OQ,   1550F 4HRS AC, 1400F 4HRS AC
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.33	F(HZ)= 20.00		
DELTA K MIN	A:	11.78	2.13			
	B:	19.24		3.55		
	C:					
	D:					
		13.00	2.88			
		16.00	5.02			
		20.00	8.34	3.86		
		25.00	12.9	6.37		
		30.00	18.0	9.75		
		35.00	23.5	13.9		
		40.00	29.6	18.8		
		50.00	44.6	29.7		
		60.00	66.0			
		70.00	102.			
		80.00	191.			
DELTA K MAX	A:	89.65	450.			
	B:	50.41		30.2		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	21.40	14.51

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT: 1875F 4HRS OQ. 1550F 4HRS AC. 1400F 4HRS AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 153.7 KSI
ULT. STRENGTH: 199.7 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

NICKEL BASE

WASPALOY

Figure 5.12.3.17

TABLE 5.12.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 1875F 4HRS OQ, 1550F 4HRS AC, 1400F 4H
           RS AC
ENVIRONMENT: +1200F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F=2 MIN HOLD TRAPEZOIDAL	F=5 MIN HOLD TRAPEZOIDAL	F=15 MIN HOLD TRAPEZOIDAL	
DELTA K MIN	A: 24.46	14.4			
	B: 46.10		371.		
	C: 24.76			14.5	
	D:				
	25.00	15.9		15.5	
	30.00	33.8		47.5	
	35.00	59.1		105.	
	40.00	92.8		191.	
	50.00	196.	443.	478.	
	60.00	383.	938.	1008.	
	70.00	734.	1069.	2007.	
	80.00	1410.	1951.	3939.	
	90.00			7765.	
DELTA K MAX	A: 81.37	1544.			
	B: 82.36		2544.		
	C: 95.27			11155.	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	41.89	26.98	33.21

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1875F 4HRS OQ. 1550F 4HRS AC. 1400F 4HRS AC
FORM: DISK
SPECIMEN TYPE: WOL
ORIENTATION: C-R
STRESS RATIO: +0.05
ENVIRONMENT: +1200° F. AIR

YIELD STRENGTH: 153.7 KSI
ULT. STRENGTH: 199.7 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: PW004

(A) ΔK (MPA √m)
FREQUENCY = 2 MIN. HOLD
TRAPEZOIDAL WAVEFORM
da/dN (in/cycle)
da/dN (mm/cycle)

(B) ΔK (MPA √m)
FREQUENCY = 5 MIN. HOLD
TRAPEZOIDAL WAVEFORM

(C) FREQUENCY = 15 MIN. HOLD
TRAPEZOIDAL WAVEFORM
da/dN (in/cycle)
ΔK (KSI √in)

(D) FREQUENCY (Hz)
da/dN (mm/cycle)
ΔK (KSI √in)

Figure

TABLE 5.12.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 5.12.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 2010F 2HR, 1350F 6HR(COARSE GS, SMALL
           PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)		A	B	C	D
		R=+0.10			
DELTA K MIN	A: 43.83	1.29			
	B:				
	C:				
	D:				
	50.00	2.84			
	60.00	10.1			
	70.00	20.3			
DELTA K MAX	A: 70.45	20.8			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	13.73

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 2010F 2HR. 1350F 6HR(COARSE GS. SMALL PRECIPITATES)
FORM: 1.18"TH BILLET   YIELD STRENGTH: 95.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 230.5 KSI
ORIENTATION: SPECIMEN THK: 0.125"
FREQUENCY: 10.00 HZ   SPECIMEN WIDTH: 1.250"
ENVIRONMENT: R.T.,LAB AIR   REFERENCES:UC001

NICKEL
BASE

WASPALOY

Figure 5.12.3.19

TABLE 5.12.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
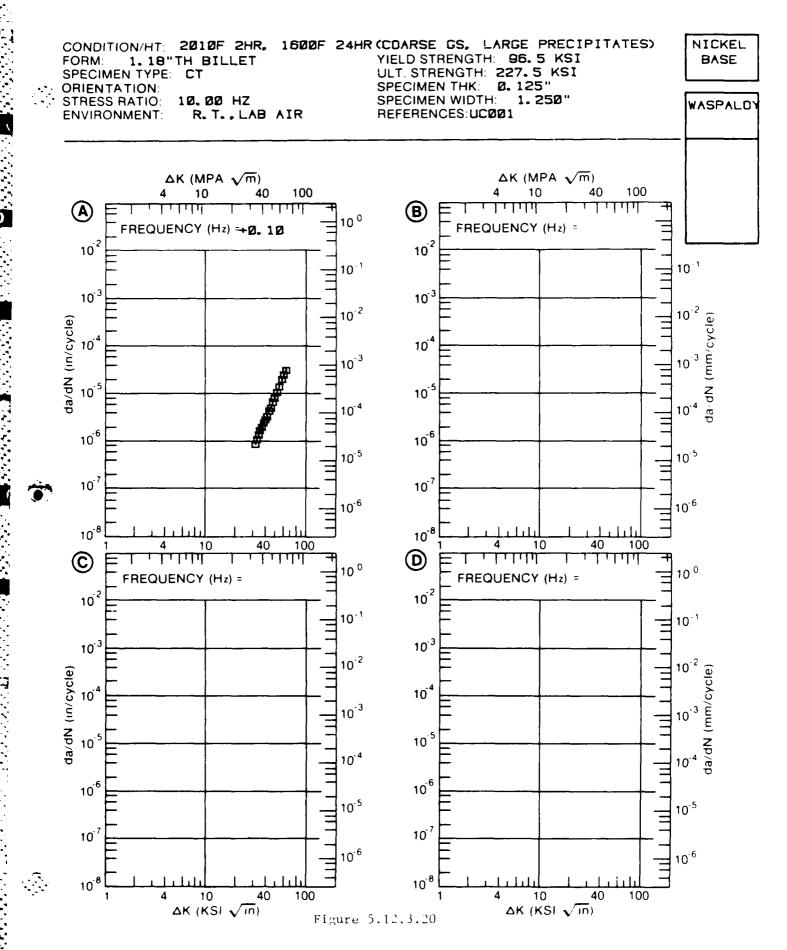
DATA ASSOCIATED WITH FIGURE5.12.3.20 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: NICKEL BASE   WASPALOY
CONDITION: 2010F 2HR, 1600F 24HR(COARSE GS, LARGE
           PRECIPITATES)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10			
DELTA K MIN	A: B: C: D:	30.90	.893			
		35.00	1.66			
		40.00	3.19			
		50.00	9.65			
		60.00	25.5			
DELTA K MAX	A: B: C: D:	62.77	32.9			

ROOT MEAN SQUARE PERCENT ERROR	7.17

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 2010F 2HR. 1600F 24HR (COARSE GS, LARGE PRECIPITATES)
FORM: 1.18"TH BILLET   YIELD STRENGTH: 96.5 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 227.5 KSI
ORIENTATION: SPECIMEN THK: 0.125"
STRESS RATIO: 10.00 HZ   SPECIMEN WIDTH: 1.250"
ENVIRONMENT: R.T., LAB AIR   REFERENCES:UC001

| NICKEL |
| BASE |

| WASPALOY |

Figure 5.12.3.20

Table 5.13

REFERENCES FOR THE NICKEL BASE ALLOY DATA

60578   Inconel 718 K_c

Christian, J.L., Yang, C.T., and Witzell, W.E., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment," ASD-TDR-62-258, Part III, General Dynamics/Astronautics, December 1964.

88187   Inconel 718 K_{Ic}

"Inconel 718 Test Data of September 19, 1973," Shultz Steel Company, South Gate, CA., September 1, 1973.

88579   Inconel 718 da/dN

"B-1 Program da/dN Data for Aluminum Alloys," Rockwell International Corporation; Memorandum to H.D. Moran from E.W. Cawthorne, Battelle's Columbus Laboratories, April 3, 1974.

88700   Inconel 718 K_{Iscc}

Gilbreath, W.P., and Adamson, M.J., "The Stress Corrosion Susceptibility of Several Alloys in Hydrazine Fuels," NASA Technical Note, Report NASA TN D-7604, Ames Research Center, Moffett Field, CA., February 1974.

GE001   Inconel 718 da/dN
         P/M Rene 95 da/dN

Shanini, V. and Popp, H.G., "Evaluation of Cyclic Behavior of Aircraft Turbine Disk Alloys," General Electric, Evendale, Ohio, Contract No. NAS3-20368, Report No. NASA-CR-159433, June 1978.

GE004   P/M Rene 95 da/dN

"Argon Environment Testing," Thermal-Mechanical Crack Propagation Program; Data Sheets sent from M.S. Gilbert, General Electric Co., Evendale, Ohio, Contract No. F33615-77-C-5193, November 1980.

GE005   Inconel 718 da/dN

"Fatigue Crack Growth Rate Data on Inconel 718 Using K_B Bar Specimens from the TF34 DTA Effort;" Data sent from M.S. Gilbert, General Electric Co., Evendale, Ohio, October 1982.

GE008   Inconel 718 da/dN
         P/M Rene 95 da/dN

Domas, P.A., "Crack Propagation Under Thermal Mechanical Cycling," General Electric Co., Aircraft Engine Group, Evendale, Ohio, Contract No. F33615-77-C-5193, November 1979.

HD003   Inconel 600 da/dN

James, L.A., "Fatigue Crack Propagation Behavior of Inconel 600," International Journal of Pressure Vessels and Piping, Vol. 5, 241-259. 1977.

HD005   Inconel 625 da/dN

James, L.A., "The Effect of Temperatures upon the Fatigue Crack Propagation Behavior of Inconel 625," Report HEDL-TME 77-2, Westinghouse Hanford Co., Richland, WA., March 1977.

HD015   Inconel 718 da/dN

James, L.A., "Fatigue Crack Propagation Behavior of Inconel 718," Report HEDL-TME 75-80. Westinghouse Han   . Co., Richland, WA., September 1975.

Table 5.13 (Continued)

HD016   Inconel 718 da/dN

Mills, W.J., and James, L.A., "Effect of Heat Treatment on Elevated
Temperature Fatigue-Crack Growth Behavior of Two Heats of Alloy 718,"
ASME Paper 78-WA/FVP-2, December 1978.

HD017   Inconel 718 da/dN

James, L.A., "The Effect of Product Form Upon the Fatigue-Crack
Growth Behavior in Alloy 718," Journal of Engineering Materials
and Technology, Vol. 103, 234-239, 1981.

PW001   Waspaloy da/dN

Larsen, J.M., Schwartz, B.J., Annis, C.G. Jr., "Cummulative Damage
Fracture Mechanics Under Engine Spectra," Pratt and Whitney Aircraft
Group, Government Product Division, West Palm Beach, Fla., Report
No. AFML-TR-77-4159, January 1980.

PW002   IN 100 da/dN

Larsen, J.M., Schwartz, B.J., Annis, C.G. Jr., "Cummulative Damage
Fracture Mechanics Under Engine Spectra," Pratt and Whitney Aircraft
Group, Government Product Division, West Palm Beach, FL., Report
No. AFML-TR-77-4159, January 1980.

PW003   Astroloy 901 da/dN
            IN 100 da/dN
            Incoloy 901 da/dN

Fatigue Crack Growth Rate Data on Titanium and Nickel Base Alloys from
B.S. Schwartz, Pratt and Whitney Aircraft Group, Government Product
Division, West Palm Beach, FL., July 1982.

PW004   Astroloy P/M da/dN
            IN 100 P/M da/dN
            NASAIIB-7 P M da/dN
            Waspaloy da/dN

Cowles, B.A., Sims, D.L., Warren, J.R., "Evaluation of the Cyclic
Behavior of Aircraft Turbine Disk Alloys," Pratt and Whitney Aircraft
Group, United Technologies Corp., West Palm Beach, FL., Contract No.
NAS3-20367, Report No. NASA CR-159409, October 1978.

PW006   IN 100 da/dN
            Waspaloy da/dN

Fatigue Crack Growth Rate Data on Nickel Base Alloys from Pratt and
Whitney Ai· ·aft Group, Government Product Division, West Palm Beach,
FL., July ·

RI006   Inconel 718 K_{Iscc}

Ferguson, R.R., Berryman, R.C., "Fracture Mechanics Evaluation of
B-1 Materials," Rockwell International B-1 Division, Los Angelos, CA.,
Contract No. F33657-70-C-0800, Report No. AFML-TR-76-137, October 1976.

UC001   Waspaloy da/dN

Lawless, B., et.al., "The Effect of Microstructure on the FCP and
Overload Behavior of Waspaloy at Room Temperature," Dept. of Materials
Science and Metallurgical Engineering, University of Cincinnati,
December 1980.

CHAPTER 6

ALLOY STEEL SECTIONS

TABLE 6.0.1

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	...	...	K CURVES	DA/DN	DA/DT	KISCC
AF1410	... 1500F 1HR AC, 950F 5HRS AC	ROUND BAR				x		
	1500F 1HR, WQ 1500F 1HR, WQ 950F 5HRS AC	PLATE	x					
AF1410/HP9-4-30	1500F 1HR WQ 1500F 1HR WQ 950F 5HRS AC	PLATE	x			x		
4340	1500F 0.5-1 HR WQ 1125F, 1.5HR AC	PLATE ROUND BAR				x x		
D6AC	HEAT TREATED TO 46 RC HARDNESS	PLATE	x					
	1550F AQ 650F 4HR	SHEET						x
	1550F AQ 950F 4HR	SHEET						x
	1550F 25 MIN QQ 850F 1+1 HR	SHEET	x					x
	1600F 1 25HR, A-BQ 325F, AC, 925-945F 3HR, 1000F 6-6.5HR	FORGING	x					
	1650F AUS-BAY QUENCH 975F. SQ 325F, 1000F 1+2 HR	PLATE	x			x		
	1650F AUS-BAY QUENCH 975F. SQ 325F, 1000F 1+2 HR	PLATE FORGING	x x			x		
	1650F A-BQ AT 975F, SQ AT 400F, 1000F 1+2HR	PLATE FORGING	x x			x x		
	1650F 1 HR FC TO 950F QQ AT 400F, AC, 1025F 1+2 HR	FORGING	x					
	1650F 1 HR FC 1670F 1 HR QQ, 1025 1+2 HR	BILLET	x					

6.0-3

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	FTU	KIC	R CURVES	DA/DN	DA/DT	KISCC
D6AC	1650F 1 HR.FC TO 965F.OQ AT 1150 AC 1000F 2+2 HR	BILLET	X					
	1675F AC 1575F OQ.400F 2 HR. 1150F 2 HR (RC 42.5)	PLATE	X					
	1675F AC.1575F OQ.400F 2 HR. 400F 2 HR (RC 46.5)	PLATE	X					
	1675F.AC.1575F OQ.400F 2 HR. 500F 2 HR (RC 50)	PLATE	X					
	1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR	PLATE FORGING	X X			X X		
	1700F.1 HF.FC TO 965F.OQ AT 150F.AC.1000F 2+2 HR	BILLET	X					
	1700F.1 HR.OQ.1025F 2+2 HR	BILLET	X					
	1725F 1 HR.AC 1700F 1 HR.OQ. 1000F 1 HR. 1015F 1 HR	BILLET	X					
	1725F.1 HR.AC 1700F 1 HR.OQ. 1190F 2+2 HR	BILLET	X					
	1775F.1 HR.AC 1700F 1 HR.OQ. 1050 2+2 HR	BILLET	X					
	1775F.1 HR.AC 1675F 1 HR.FC 163 965F.SG.350F 0.5 HR.AC. 1625F 2+2 HR	BILLET	X					
HP9-4-20	----	PLATE BAR FORGING	X			X X	X X	X X
	ANNEALED	FORGING	X					
	GTA WELD WELDMENT	PLATE						X

6.0-4

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
	HEAT TREATED	FORGING	X					
	WELDED	WELDMENT				X		
	QUENCHED AND TEMPERED	PLATE						X
	15.5F OQ. 100F 1HR, 1025J 4+4HR	FORGING	X					
	15.5F 2HRS AC, 100F 2HRS, 1025F 4HRS	BILLET				X		
	15.5F 2HRS OQ. 100F 2HRS, 1025F 4HRS	PLATE BILLET FORGED BAR				X X		X X
	15.5F 1-2 HR AC, 15.5F 1-2 HR OQ. 100F 2HR, 1025F 4-6HR	FORGING	X					
	1650F 1-2HR AC, 100F 1-2HR, 1025F 4HR	FORGING	X					
	1650F 1-2HR AC 1525F 1-2HR OQ. 100F 2HR, 1025F 4-6HR	PLATE FORGING	X X					
	1525F 1-2HR AC 1525F 1-2HR OQ. 100F 2HR. 1000F 4-6HR	FORGING	X					
	1525F 1-2HR AC 1525F 1-2HR. 100F 2HR. 1000F 4-6HR	FORGING	X					
	1550F 2HR AC. 1525F 2HR OQ. 1650F 2+1HR AC	FORGING	X					
	1550F 1-2HR AC 1-2HR AC, 100F 1-2HR, 1025F 1025F 4HR	PLATE	X					
	1525F 1-2HR AC 1-2HR AC, 1130F 1-2HR, 1025 1025F 4HR	PLATE	X					
	1550F 1-2HR AC 1-5HR OQ. 1025F 12HR	FORGING	X					

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
HP9-4-20	1500F 4 GHR AC TO 900F HELD 0 GHR AC 100F 1 5HR, 1025F 8HR ?	FORGING	X					
	1500F 4 5HR AC 1700F 1 5HR AC -100F 1 5HR, 10.5F 4HRS	FORGING	X					
HP9-4-30(CFM)	ANNEALED	FORGING	X			X		
HP9-4-30	1550F 1 HR OQ 1000F 2+2HR AC	FORGING	X					
HP9-4-30	---	PLATE				X		
		BAR				X		
		FORGING	X			X		
	HEAT TREATED TO 42 RC HARDNESS	PLATE	X					
	QUENCHED + TEMPERED AT 900F	PLATE				X		
	UTG-220 240KSI	BILLET				X		
	1525F 2HRS OQ -100F 1HR, 1025F 2+2HR	FORGED BAR				X		
	1525F 2HRS OQ -100F 2HRS, 1025F 2+2HR	FORGED BAR				X		
	1550F 2HRS OQ -100F 3HRS, 1000F 2+2HRS	FORGED BAR				X		
	1525F OQ -100F 3HR, 1050F 4HR	FORGING	X					
	1550F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1000F 4HR	FORGING	X					
	1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1025F 4HR	FORGING	X					X

TABLE 6.0.1 (con't)

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
HP9-4-30	1650F 1-2HR AC 1525F 1-2HR OQ, 100F 1-3HR. 1050F 4HR	FORGING	x					
	1550F 2HRS AC 1550F 2HR OQ. -100F 2HR AC. 1000F 4HR, AC 1000F 4HR, AC	FORGING	x					
	1650F. 2HR AC 1550F 2HR OQ 1000F 2+2HR AC	FORGING	x					
	1650F. AC,1525F 1 2HR OQ, 100F 1-2HR. 1050F 4HR	FORGING	x					
HP9-4-45	1600F O 5HR AC 1500F O 33HR AC 475F	SHEET						x
		PLATE						x
HY-TUF	1700F 1HR AC. 1500F 1HR, 1000F 20 MIN. OQ, 550F 2HR	FORGING	x					
	1700F 1HR.AC, 1600F 1HR.OQ, 550F 2HR	FORGING	x					
HY 150	1500F 1HR WQ	PLATE						x
HY 180	STA (UTS 180KSI)	FORGED BAR				x		
HY 80	---	---				x		
H11	---	---					x	
	AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR				x		
	QUENCHED + TEMPERED AT 1100F	PLATE						x
	1325F.1850F O 5HR AC.1060F 2+2HR	SHEET						x

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
IONI SITE	—	PLATE					x	x
12 P??MAR	RTA 701	ROUND BAR	x				x	x
IONI CR M	—	PLATE						x
	ELECTRIC FURNACE	PLATE						x
	GTA WELDED	WELDMENT						x
	LOW RESIDUAL	PLATE						x
	TYS-150 OKSI	PLATE						x
	TYS-160 OKSI	PLATE						x
	TYS-170 OKSI	PLATE						x
	TYS-175 OKSI	PLATE						x
	1500F 900F 20HR AC	PLATE						x
18NI(180)(MAR)	TYS-170KSI	PLATE						x
	TYS-175KSI	PLATE						x
	TYS-178KSI	PLATE						x
	TYS-185KSI	PLATE						x
	TYS-190KSI	PLATE						x
	TYS-195KSI	PLATE						x
	TYS-200KSI	PLATE						x
	1500F 1HR AC 900F 3HR	PLATE						x

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
18NI(200)(MAR)								
	---	PLATE						x
	TYS=215 KSI	PLATE						x
	WELD CENTER LINE	PLATE						x
	1500F 1HR AC 900F 3HR	PLATE						x
	1650F 4 5 HR, AC, AGED 1000F 6 HR	PLATE	x					
	1650F 4 5 HR, AC, AGED 950F 24 HR	PLATE	x					
	1650F 4 5 HR, AC, AGED 900F 24 HR	PLATE	x					
	1650F 4 5 HR, AC, AGED 900F 6 HR	FORGING	x					
	1650F, 4 5 HR, AC, AGED 850F 24 HR	FORGING	x					
	1650F 900F 3HR AC	PLATE						x
	1675F 2HR AC 500F 15MIN 850F 4HR COOL 250F/MIN	PLATE						x
18NI(250)(MAR)								
	---	PLATE				x		x
	AGE 900F 3HR	PLATE						x
	AGED 900F 3HR AC	PLATE						x
	TYS=243KSI	BILLET					x	
	TYS=250KSI	PLATE						x
	TYS=260KSI	PLATE						x

TABLE 6.0.1 (con't)
AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
18NI(250)(MAR)	1500F AC 850F 6 HR	PLATE	X					
	1500F AC 900F 24 HR	PLATE	X					
	1500F AC 950F 6 HH	PLATE	X					
	1500F 1HR AC AGED 900F 3HR AC	BILLET	X					
	1500F AC 900F 6 HR	PLATE	X					
	1650F 1 25HR WQ 1525F 1 25HR WQ 900F 3HR AC	PLATF						X
	900F 2HR AI	SHEET						X
18NI(280)(MAR)	1500F 1HR AC 900F 3HR	PLATE						X
18NI(300)(MAR)	----	SHEET / FORGING		X			X	
	AGED	----				X		
	ANNEALED	----				X		
	AGE 900F 6HR	FORGING				X		X
	AGE 950F 12HR	FORGING						X
	CRACK PRESTRESSED TO 50 PCT KIC	FORGING						X
	CRACK PRESTRESSED TO 25 PCT KIC	FORGING						X
	CRACK PRESTRESSED TO 80 PCT KIC	FORGING						X
	1500F 0 5HR AC 900F 3HR	PLATE						X
	1500F 2HR 800F 10HR	BAR						X
	1500F 2HR 900F 3 5HR	BAR						X

TABLE 6.0.1 (con't)
AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
18NI(300)(MAR)	1500F 2HR 900F 100HR	BAR						x
	1700F, 1500F AGED 900F 6HR	FORGING						x
	2300F 1HR 1700F 4HR. 900F 100HR	BAR						x
	2300F 1HR 1700F 4HR 800F 10HR	BAR						x
	2300F 1HR 1700F 4HR 900F 100HR	BAR						x
	2300F 1HR 1700F 4HR 900F 3 HR	BAR						x
	900F 3HR 950F 3HR	FORGING						x
	1700F 1HR. AC. 1500F 1 HR. AC. 900F 6 HR	FORGING	x					
	900 F AGED	PLATE	x					
18NI(350)(MAR)	AGED 8HR 800F	FORGED BAR					x	x
	AGE 900F 3HR	FORGED BAR						x
	AGE 900F 8HR	FORGED BAR						x
	1500F 1HR 800F 8HR	FORGING						x
	1500F 1HR 900F 8HR	FORGING						x
	1500F 1HR 950F 3HR	FORGING						x
:300F	1500F 1HR 950F 3HR	PLATE FORGING	x			x	x	x x

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TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
300M	AMS 6434 UTS-220-240KSI	PLATE		x				
	UTS-240-280KSI	PLATE		x				
	UTS-280-300KSI	SHEET		x	x			
		PLATE		x	x			
	HEAT TREATED TO 54 RC HARDNESS	PLATE	x					
	UTS-280-300KSI	BAR				x		
		BILLET				x		
	1500F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1500F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1500F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE)	PLATE						x
	1500F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE)	PLATE						x
	1550F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE)	PLATE						x
	1550F 0.5HR OQ 400F 2+2 HR (FINE GRAINED STRUCTURE)	PLATE						x
	1550F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1550F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1600F 0.5HR OQ 400F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1600F 0.5HR OQ 550F 2+2 HR (COARSE GRAINED STRUCTURE)	PLATE						x
	1600F 0.5HR OQ 550F 2+2 HR (FINE GRAINED STRUCTURE)	PLATE						x

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
300M	1600F DQ. 575F 2+2HR	SHEET					X	
	1600F 0 5 HR. SQ.1000F CO. 1 0 HR. DQ 80 180F 25 MIN 575F 2+2HR	FORGING	X					
	1600F 1.25 HR DQ. 600F 2+2HR	FORGING	X					
	1600F 1HR. DQ. 475F 1HR	BAR	X					
	1600F 1HR. DQ. 1HR.WQ 475F 1HR	BAR	X					
	1600F 1HR. DQ. 615F 1 HR	BAR	X					
	1600F 1HR. DQ. 575F 1HR	BAR	X					
	1600F 1HR. DQ. 745F 1HR	BAR	X					
	1600F DQ 550F 2+2HR	PLATE	X					
	1625F.1575F WQ 600F 2+2HR	FORGING						X
	1625F 1600F 1HR DQ 600F 1+1 HR	FORGING						X
	1625F AC 1575F DQ 800F 2HR (Rc 4 5)	PLATE	X					
	1625F AC 1575F DQ 500F 2HR (Rc 51 5)	PLATE	X					
	1625F. AC.1575F DQ.1100F 2HR (Pc 30)	PLATE	X					
	1700F 1.5HRS AC.1600F 1.5HRS DQ.600F 2+2HRS	FORGING				X		X
	1 1HR 1HR AC.1600F 1HR DQ. 600F 2HR AC (AMS 6412)	PLATE	X					X
	1710F 1610F 610F	BAR						X

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TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
300M	2190F 1HR.FC TO 1600F HOLD 0.5HR.OQ.475F 1HR	BAR	x					
	2190F 1HR.FC TO 1600F.HOLD 0.5HR.OQ.615F 1HR	BAR	x					
	2190F 1HR.FC TO 1600F.HOLD 0.5HR.OQ.745F 1HR	BAR	x					
	2190F 1HR.OQ.400F 1HR	BAR	x					
	2190F 1HR.OQ.475F 1HR	BAR	x					
	2190F 1HR.OQ.475F 1HR.WQ.475F 1HR	BAR	x					
	2190F 1HR.OQ.615F 1HR	BAR	x					
	2190F 1HR.OQ.745F 1HR	BAR	x					
300M (AM)	1550F 1 HR.AC.1550F 1 HR.OQ.320F 0.5 HR.600F 2+2HR.AC	FORGING	x					
300M (VAR)	1650F 1 HR.AC.1550F 1 HR.OQ.320F 0.5 HR.600F 2+2HR.AC	FORGING	x					
300M(VM)	1500F.OQ.400F 2+2HR	PLATE	x					
	1500F.OQ.550F 2+2HR	PLATE	x					
	1550F.OQ.400F 2+2HR	PLATE	x					
	1550F.OQ.550F 2+2HR	PLATE	x					
	1600F.OQ.400F 2+2HR	PLATE	x					
	1600F.OQ.550F 2+2HR	PLATE	x					
	1700F.AC.1600F 1 HR.OQ.550F 2+2 HR	BILLET	x					

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
300M(VAR)	1700F AC 1600F 1HR SQ 975F OQ.575F 2.5 HR	BILLET	x					
	1700F AC 1600F 1 HR SQ 400F AC..HF 2.5 HR	BILLET	x					
4140	1550F 1HR OQ 1250F 1HR AC	PLATE	x					x
	1550F 1HR OQ 1000F 1HR AC 1150F 1HR AC	PLATE	x					x
	1600F 1 HR OQ 400F 1HR	FORGED BAR	x					
	1600F 1 HR OQ 745F 1HR	FORGED BAR	x					
	1600F 1 HR OQ 535F 1HR	FORGED BAR	x					
	1600F 1HR, 1550F 1HR, OQ AT 170-175F, 900F 1HR	PLATE	x					
	1600F 1HR, 1550F 1HR, OQ AT 150 175F, 800F 1HR	PLATE	x				x	x
	1700F 1600F OQ 750F 1+1 HR	PLATE	x					
	1700F 1600F OQ 600F 1+1 HR	PLATE						
	2010F 1 HR OQ 400F 1 HR	FORGED BAR	x					
	2010F 1 HR OQ 475F 1 HR	FORGED BAR	x					
	2190F 1 HR OQ 400F 1 HR	FORGED BAR	x					
	2190F 1 HR OQ 660F 1 HR	FORGED BAR	x					
	2190F 1 HR OQ 615F 1 HR	FORGED BAR	x					
	2190F 1 HR OQ 475F 1 HR	FORGED BAR	x					
4330V	QUENCHED + TEMPERED AT 500F	PLATE						x

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIE	KC	R CURVES	DA/DN	DA/DT	KISCC
4340 MOD		BILLET	x					
	HEAT TREATED TO 46 R<sub> HARDNESS	PLATE	x			x		
	1 HR, AC 400F 1 HR	FORGED BAR	x					
	1 HR, AC 600F 1 HR	FORGED BAR	x					
	1 HR, AC 1575F 1 HR, AC 600 HR	BILLET	x					
	1 HR, AC 1575F 1 HR, AC 600 HR	BILLET	x					
		SHEET					x	x
		PLATE					x	x
		FORGING						x
14-5	HEAT TREATED TO 51 R<sub> HARDNESS	PLATE	x					
	AS TEMPERED	PLATE			x		x	x
	TEMPERED 400F	PLATE					x	x
	TEMPERED 450	PLATE						x
	450KSI	PLATE						x
	170KSI	PLATE						x
	175KSI	PLATE						x
	200KSI	PLATE						x
	GOKSI	EXTRUSION					x	
	4KSI	PLATE						x

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TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
4340	UTS - 160 KSI	ROUND BAR				x		
	UTS - 180 KSI	ROUND BAR	x			x		
	UTS-180 200KSI	BAR PLATE				x x		
	1550F QQ 750F 1 2HR	PLATE						x
	1550F QQ. TEMPERED 800F	PLATE	x					
	1550F QQ. TEMPERED 500F	PLATE	x					
	1550F QQ 750F CRACK PRESTRESSED TO 90PCT KIC	PLATE						x
	1550F QQ 750F 1HR CRACK PRESTRESSED TO 90PCT KIC	PLATE						x
	1550F QQ 750F CRACK PRESTRESSED TO 90PCT KIC	PLATE						x
	1550F QQ 750F CRACK PRESTRESSED TO 90PCT KIC	PLATE						x
	1550F QQ 750F CRACK PRESTRESSED TO 90PCT KIC	PLATE						x
	1550F QQ 675F 4HR	PLATE						x
	1550F QQ 800F 4HR	PLATE						x
	1550F 1 HR QQ 420F 1 HR	FORGED BAR	x					
	1600F 1 HR QQ 745F 1 HR	FORGED BAR	x					
	1550F 1 HR QQ 650F 1 HR	FORGED BAR	x					
	1550F 1 HR QQ 450F 1 HR	FORGED BAR	x					
	1550F 1HR, 1550F, 500F 1HR AC 1550 1/2F, 900F 1HR	PLATE	x					
	1550F 1HR QQ 500F 1+1HR	FORGING						x
	QQ 1525F QQ 400F 2+2HR 1525F QQ	FORGING						x

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
4340	1650F 1HR AC 1680F 2HR OQ,LN 0.25HR,400F 1+1HR OQ	BAR						x
	1650F 1HR AC 1480F 2HR OQ,LN 0.25HR,400F 1+1HR OQ	BAR						x
	1650F 1 HR,AC,1525F 1 HR,OQ, 800F 2 HR	BILLET	x					
	1700F O 25HR AC 1550F OQ 800F 1+1HR	SHEET						x
	1800F 0.600F 1+1HR	FORGING						x
	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 400F 1 HR	FORGED BAR	x					
	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 660F 1 HR	FORGED BAR	x					
	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 535F 1 HR	FORGED BAR	x					
	2190F 1HR,OQ, 475F 1HR	FORGED BAR	x					
	2190F 1HR. OQ. 535F 1HR	FORGED BAR	x					
	450F TEMPER	---				x		
	750F TEMPER	---				x		
4340 (AM)	1400F 1 HR,AC,1550F 1 HR,OQ, 320F O 5 HR. 400F 2 HR.AC	FORGING	x					
4340 (OD)	1550F,OQ, 900F 1 HR	BILLET	x					
	1400F 1 HR,AC,1550F 1 HR,OQ, 320F O 5 HR. 400F 2 HR.AC	FORGING	x					
4340 (VAR)	1600F 1 HR,AC,1550F 1 HR,OQ, 320F O 5 HR. 400F 2 HR.AC	FORGING	x					
4340 (EFM)	1550F 5HR,400F 4HR	PLATE					x	

TABLE 6.0.1 (con't)

AVAILABLE DATA FOR ALLOY STEEL

ALLOY	CONDITION/HT	PRODUCT FORM	KIC	KC	R CURVES	DA/DN	DA/DT	KISCC
4340V	1650F 1HR, 1600F 1HR OQ 1+1 600F (0 09 SI)	EXTRUSION					X	
4340(MOD)	1650F 1HR, 1600F 1HR OQ 1+1 400F (0 09 SI)	BAR						X
	1650F 1HR, 1600F 1HR OQ 1+1 400F (0 09 SI)	DAR						X
	1800F @ 450F 1+1HR (0 20C)	FORGING						X
	1800F @ 500F 1+1HR (0 21C)	FORGING						X
	1800F @ 600F 1HR (0 20C)	FORGING						X
	1800F @ 650F 1HR (0 24C)	FORGING						X
	1800F @ 650F 1+1HR (0 28C)	FORGING						X
	1800F @ 700F 1HR (0 21C)	FORGING						X
	1800F @ 780F 1+1HR (0 33C)	FORGING						X
	1800F @ 800F 1HR (0 46C)	FORGING						X
	1800F @ 900F 1HR (0 64C)	FORGING						X
	1800F @ 925F 1+1HR (0 53C)	FORGING						X

TABLE 6.0.2

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
AF1410	1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC	PLATE	2.00	1.75	139.6	11.7	1.75	136.7	7.4	---	---	---
D6AC	HEAT TREATED TO 46 RC HARDNESS	PLATE	---	---	---	---	0.70	85.8	1.8	---	---	---
	1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR	FORGING	---	---	---	---	1.00	78.4	15.1	0.97	83.9	14.8
	1650F AUS-BAY QUENCH 975F, BQ 325F, 1000F 2+2 HR	PLATE	0.80-1.50	0.75	66.9	18.7	---	---	---	---	---	---
	1650F AUS-BAY QUENCH 975F, BQ 375F, 1000F 2+2 HR	PLATE	1.50	0.60	62.2	14.0	---	---	---	---	---	---
		FORGING	1.50	0.75	46.0	4.2	---	---	---	---	---	---
	1650F, AUS-BAY QUENCH 975F, BQ 400F, 1000F 2+2 HR	PLATE	0.80	0.60	64.4	12.1	---	---	---	---	---	---
		FORGING	0.80-1.50	0.60	66.2	12.3	---	---	---	---	---	---
	1650F, 1 HR, FC 1650F 1 HR, OQ, 1025F 2+2 HR	BILLET	7.00	1.00	78.5	4.7	---	---	---	---	---	---
	1650F, 1 HR, FC TO 960F, OQ AT 150F, AC, 1000F 2+2 HR	BILLET	7.00	1.00	80.3	0.8	---	---	---	---	---	---
	1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR	PLATE	0.80-1.50	0.61	92.0	8.2	---	---	---	---	---	---
		FORGING	0.80-1.50	0.75	95.2	6.4	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			B-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
D6AC	1700F,1 HR,FC TO 960F,OQ AT 150F,AC,1000F 2+2 HR	BILLET	7.00	1.00	80.3	4.3	---	---	---	---	---	---
	1700F,1 HR,OQ, 1025F 2+2 HR	BILLET	7.00-10.00	1.00	77.3	2.6	---	---	---	---	---	---
	1725F 1 HR,AC 1700F 1 HR,OQ, 1000F 1 HR, 1015F 1 HR	BILLET	7.00	1.00	77.2	2.7	---	---	---	---	---	---
	1725F,1 HR,AC 1700F 1 HR,OQ, 1100F 2+2 HR	BILLET	7.00-10.00	1.00	101.2	6.1	---	---	---	---	---	---
	1725F,1 HR,AC 1700F 1 HR,OQ, 1025F 2+2 HR	BILLET	7.00-10.00	1.00	74.4	6.2	---	---	---	---	---	---
	1725F,1 HR,AC 1650F 1 HR,FC TO 960F,BQ 350F 0.5 HR,AC 1025F 2+2 HR	BILLET	7.00	1.00	75.1	10.1	---	---	---	---	---	---
HP 9-4-.20	---	FORGING	1.25	2.00	150.6	4.5	2.00	136.3	16.8	---	---	---
	ANNEALED	FORGING	3.00	1.00	120.6	7.3	2.00	117.7	1.9	---	---	---
	HEAT TREATED	FORGING	3.40-7.00	1.50	140.7	4.5	1.46	132.3	4.6	---	---	---
	1525F OQ.-10OF 1HR,1065F 4+4HR	FORGING	4.00	---	---	---	1.50	111.7	2.0	---	---	---
	1650F 1-2 HR AC,1525F 1-2 HR OQ,-10OF 2HR,1050F 4-6HR	FORGING	3.00-3.25	1.50	133.2	3.9	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
HP 9-4-20	1650F 1-2HR AC,1525F 1-2 HR AC,-100F 1-2HR,1025F 4HR	FORGING	4.00-7.00	1.75	134.8	12.3	1.76	109.7	4.7	---	---	---
	1650F 1-2HR AC 1525F 1-2HR	PLATE	2.50	2.00	121.5	29.0	---	---	---	---	---	---
	DG,-100F 2HR, 1025F 4-6HR	FORGING	4.00	2.00	142.8	10.7	---	---	---	---	---	---
	1650F 1-2HR AC 1525F 1-2HR DG,-100F 2HR, 1025F 4-6HR	FORGING	4.00	1.51	129.1	9.7	1.51	125.3	1.8	---	---	---
	1650F 2HR AC, 1525F 2HR DG, 1000F 2+2HR AC	FORGING	4.00	1.24	94.4	4.4	---	---	---	---	---	---
	1650F,1-2HR,AC 1-2HR,AC,-100F 1.5HR,1025F 4 HR,1060F 6HR	PLATE	2.50	2.00	123.5	12.0	---	---	---	---	---	---
	1650F,1-2HR,AC 1.5HR DG,1025F 12HR	FORGING	4.00	1.55	125.9	3.9	---	---	---	---	---	---
	1650F,4.5HR,AC TO 900F,HELD 0.5HR,AC,-100F 1.5HR,1025F 8 HR,A-BQ	FORGING	4.00	1.54	128.5	0.7	---	---	---	---	---	---
	1700F 4.5HR,AC 1700F 1.5HR,AC -100F 1.5HR,1 025F 4HRS	FORGING	4.00	1.60	140.5	0.7	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
HP 9-4-.25(VAR)	1550F 1 HR. DQ 1000F 2+2HR AC	FORGING	3.00	---	---	---	2.00	98.9	4.5	---	---	---
HP 9-4-.30	HEAT TREATED TO 49 RC HARDNESS	PLATE	3.25	---	---	---	1.01	82.5	5.0	---	---	---
	1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR. 1000F 4HR	FORGING	3.00	1.00	106.0	1.4	1.00	89.0	3.0	---	---	---
	1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR. 1050F 4HR	FORGING	3.00	---	---	---	1.00	87.5	0.8	---	---	---
	1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR 1025F 4HR	FORGING	3.00	---	---	---	1.00	93.5	0.7	---	---	---
	1650F, 2HR AC 1550F 2HR DQ 1000F 2+2HR AC	FORGING	3.25	2.02	82.0	0.0	---	---	---	---	---	---
HV-TUF	1700F 1HR.AC, 1600F 1HR.DQ, 550F 2HR	FORGING	6.50	---	---	---	1.00	111.5	2.1	---	---	---
18NI(200)(MAR)	1650F 4.5 HR. AC,AGED 1000F 6 HR	PLATE	4.25	2.40	102.3	1.2	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

6.0-23

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN)) L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
18NI(200)(MAR)	1650F 4.5 HR, AC,AGED 950F 24 HR	PLATE	4.25	2.40	99.3	1.2	---	---	---	---	---	---
	1650F 4.5 HR, AC,AGED 900F 24 HR	PLATE	4.25	2.40	96.5	0.7	---	---	---	---	---	---
	1650F 4.5 HR, AC,AGED 900F 6 HR	FORGING	3.00	2.40	100.3	0.6	---	---	---	---	---	---
18NI(250)(MAR)	1500F AC,850F 6 HR	PLATE	4.25	1.80	76.0	1.9	---	---	---	---	---	---
	1500F AC,900F 24 HR	PLATE	2.00	1.80	80.7	1.2	---	---	---	---	---	---
	1500F AC,950F 6 HR	PLATE	2.00	1.80	84.0	2.6	---	---	---	---	---	---
	1500F 1HR, AC, AGED 900F 3HR, AC	BILLET	1.00-12.00	0.50	74.3	4.2	0.80	64.1	4.4	---	---	---
	1500F,AC,900F 6 HR	PLATE	2.00	1.80	82.3	3.2	---	---	---	---	---	---
300M	---	FORGING	1.25	1.25	52.6	2.3	1.25	52.9	2.0	---	---	---
	HEAT TREATED TO 54 RC HARDNESS	PLATE	1.00	---	---	---	0.45	58.6	3.5	---	---	---
	1600F 1.25 HR, OQ, 600F 2+2HR	FORGING	3.00	0.25	54.6	2.5	0.25	50.6	1.7	0.25	54.1	1.1
	1700F 1HR AC, 1600F 1HR OQ, 600F 2HR AC (AMS 6419)	PLATE	1.00	0.50	51.8	0.7	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN)) L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
300M	2190F 1HR,FC TO 1600F,HOLD 0.5HR,DG,475F 1HR	BAR	0.62	0.60	47.9	3.8	---	---	---	---	---	---
300M (AM)	1650F 1 HR,AC, 1550F 1 HR,DG, -320F 0.5 HR, 600F 2+2HR,AC	FORGING	4.00	0.90	46.5	3.8	---	---	---	---	---	---
300M (VAR)	1650F 1 HR,AC, 1550F 1 HR,DG, -320F 0.5 HR, 600F 2+2HR,AC	FORGING	4.50	0.90	52.2	1.3	---	---	---	---	---	---
300M(VM)	1500F,DG,400F 2+2HR	PLATE	0.56	0.50	48.0	17.0	---	---	---	---	---	---
	1500F,DG,350F 2+2HR	PLATE	0.56	0.50	49.5	10.6	---	---	---	---	---	---
	1550F,DG,350F 2+2HR	PLATE	0.56	0.50	62.5	3.5	---	---	---	---	---	---
	1700F,AC,1600F 1 HR,DG,550F 2+2 HR	BILLET	5.50	---	---	---	1.00	55.3	0.3	---	---	---
	1700F,AC,1600F 1 HR,BQ 975F, DG,575F 2+2 HR	BILLET	5.50	---	---	---	1.00	58.6	2.2	---	---	---
	1700F,AC,1600F 1 HR,BQ 400F, AC,550F 2+2 HR	BILLET	5.50	---	---	---	1.00	58.0	3.4	---	---	---
4140	2010F 1 HR,DG, 475F 1 HR	FORGED BAR	0.62	0.60	52.1	7.4	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			B-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
4140	2190F 1 HR.OG. 400F 1 HR	FORGED BAR	0.62	0.60	81.1	13.2	---	---	---	---	---	---
	2190F 1 HR.OG. 475F 1 HR	FORGED BAR	0.62	0.60	66.1	2.7	---	---	---	---	---	---
4330V MOD	HEAT TREATED TO 46 RC HARDNESS	PLATE	0.62	---	---	---	0.75	74.7	0.8	---	---	---
	1600F 1 HR.OG. 535F 1 HR	FORGED BAR	0.62	0.60	96.7	3.8	---	---	---	---	---	---
	1650F 1 HR.AC. 1575F 1 HR.OG. 800F 2+2 HR	BILLET	6.00	1.00	96.1	3.2	---	---	---	---	---	---
	1650F 1 HR.AC. 1575F 1 HR.OG. 525F 2+2 HR	BILLET	6.00	1.00	81.6	2.3	---	---	---	---	---	---
4340	HEAT TREATED TO 51 RC HARDNESS	PLATE	0.62	---	---	---	0.90	51.7	1.3	---	---	---
	1550F.OG. TEMPERED 800F	PLATE	1.00	0.80	76.6	4.6	---	---	---	---	---	---
	1550F.OG. TEMPERED 500F	PLATE	1.00	0.80	45.3	2.9	---	---	---	---	---	---
	1600F 1 HR.OG. 535F 1 HR	FORGED BAR	0.62	0.60	60.9	0.8	---	---	---	---	---	---
	1600F 1HR. 1525F 2.5HR.OG AT 150-175F, 900F 1HR	PLATE	1.00	---	---	---	1.01	88.2	1.5	---	---	---
	1650F 1 HR.AC. 1525F 1 HR.OG. 800F 2 HR	BILLET	10.00	1.00	76.3	3.6	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.2 (con't)

PLANE STRAIN FRACTURE TOUGHNESS VALUES OF ALLOY STEEL AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	RANGE OF PRODUCT THICKNESSES (IN)	KIC (KSI SQRT(IN))								
				L-T			T-L			S-L		
				SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.	SPECIMEN THICK *	MEAN	STD. DEV.
4340	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 400F 1 HR	FORGED BAR	0.62	0.60	76.8	0.1	---	---	---	---	---	---
	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 660F 1 HR	FORGED BAR	0.62	0.60	60.8	0.8	---	---	---	---	---	---
	2190F 1HR, FC TO 1600F,HOLD 0.5HR, 535F 1 HR	FORGED BAR	0.62	0.60	60.1	3.2	---	---	---	---	---	---
4340 (AM)	1600F 1 HR.AC, 1350F 1 HR.OQ, -320F 0.5 HR, 400F 2 HR.AC	FORGING	4.00	0.90	40.5	0.5	---	---	---	---	---	---
4340 (DH)	1550F, OQ, 900F 1 HR	BILLET	1.00	---	---	---	1.00	66.3	6.2	---	---	---
	1600F 1 HR.AC, 1550F 1 HR.OQ, -320F 0.5 HR, 400F 2 HR.AC	FORGING	4.00	0.90	51.0	3.0	---	---	---	---	---	---
4340 (VAR)	1600F 1 HR.AC, 1550F 1 HR.OQ, -320F 0.5HR, 400F 2 HR.AC	FORGING	4.00	0.90	55.0	4.4	---	---	---	---	---	---

* MINIMUM SPECIMEN THICKNESS (IN.).

TABLE 6.0.3

PLANE STRESS AND TRANSITIONAL FRACTURE TOUGHNESS OF
STEEL ALLOYS (WITHOUT BUCKLING CONSTRAINTS)

Alloy	Condition/Ht	Test Temp. (°F)	Specimen Orient	Width (in)	Yield Strength (Ksi)	Specimen Thickness (in) = 0.025	K_c^a (Ksi $\sqrt{in}$)
18 Ni(300) MAR	---	-423	L-T	4.0	386	86.4/7.3 (5)	
		-320	L-T	2.0	336	142.6/7.4 (5)	
				4.0	336	124.7/8.0 (5)	
		R. T.	L-T	2.0	277	132.1/4.3 (5)	
				4.0	277	128.5/3.8 (5)	
				18.0	277	110.3/10.9 (3)	

^{a} Mean/Standard Deviation (No. of Specimens)

6.0-28

TABLE 6.0.4.1

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE
STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN
ORIENTATION: L-T
STRESS RATIO: 0.02-0.10

ENVIRONMENT: LAB AIR AT R.T.
FREQUENCY: 0.10-30.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
AF1410	1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	.10-30.00		.164	.633	4.07	29.5	
	1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	.10-30.00		.102	.636	3.60	30.7	139.
AF1410(VIM-VAR)	1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC	PLATE	0.08	30.00			.646	3.88	27.3	
A286	1800F 0.5-1.0HR WQ 1325F 16HR AC	PLATE	0.05	3.00				1.59	31.5	
D6AC	1650F A-BQ AT 975F,BQ AT 400F, 1000F 2+2HR	PLATE	0.10	.10					65.2	
	1650F A-BQ AT 975F,BQ AT 400F, 1000F 2+2HR	PLATE	0.10	1.00				2.85		
	1700F A-BQ AT 975F,DQ AT 140F, 1000F 2+2HR	PLATE	0.10	1.00				5.61	51.3	
HP9-4-20	------	FORGING	0.02	0.10-20.00			.180	1.61	18.9	126
		BAR	0.02	10.00				3.58	33.2	

6.0-29

TABLE 6.0.4.1 (con't)

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE
STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN
ORIENTATION: L-T   ENVIRONMENT: LAB AIR AT R.T.
STRESS RATIO: 0.02-0.10   FREQUENCY: 0.10-30.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
HP9-4-.20(CEVM)	ANNEALED	FORGING	0.10	5.00-10.00				6.19	37.0	
HP9-4-.30		FORGING	0.02	5.00-20.00			.399	2.99	38.9	
		BAR	0.02	1.00					46.4	
		BAR	0.02	10.00				3.59	46.6	
HV-180	STA (UTS = 180 KSI)	FORGED BAR	0.10	30.00		.0986	.556	3.33		
	STA (UTS = 180 KSI)	FORGED BAR	0.10	10.00				4.27	30.8	
H11	AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.10	10.00				3.53		
	AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.10	30.00			.339	2.95		
12-9-2 MAR	STA 900	ROUND BAR	0.10	10.00				8.17		
	STA 900	ROUND BAR	0.10	30.00			.149	8.92		

TABLE 6.0.4.1 (con't)

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN
ORIENTATION: L-T   ENVIRONMENT: LAB AIR AT R.T

STRESS RATIO: 0.02-0.10   FREQUENCY: 0.10-30.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
300M	----	FORGING	0.02	.10- 20.00 SP THK=1.25"			.716	3.83	82.7	
	TUS = 280 - 300 KSI	FORGING	0.02	10.00 SP THK=0.25"				3.56	47.0	
4330V(MOD)	----	BILLET	0.02	1.00- 30.00			2.11	7.44	28.4	
4340	MARTEMPERED	PLATE	0.02	---			.492	3.12	23.0	111.
	UTS = 160 KSI	ROUND BAR	0.10	7.00				2.47		
	UTS = 180 KSI	ROUND BAR	0.10	20.00- 30.00			.507	2.96	23.2	

TABLE 6.0.4.2

COMPARISON OF FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF THE STRESS INTENSITY FACTOR FOR ALLOY STEEL

TEST CONDITIONS:

SPECIMEN
ORIENTATION: T-L

STRESS RATIO: 0.02-0.10

ENVIRONMENT: LAB AIR AT R.T.

FREQUENCY: 0.10-30.00HZ

ALLOY	CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQUENCY	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) FOR DELTA K LEVELS (KSI SQRT(IN)) =					
					2.5	5.0	10.0	20.0	50.0	100.0
AF1410	1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	.10-30.00		.134	.513	4.11	27.2	498.
	1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	.10-30.00			.717	4.07	28.1	149.
AF1410(VIM-VAR)	1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS AC	PLATE	0.08	0.10-30.00			.711	3.95	29.3	
A286	1800F 0.5-1.0HR WQ, 1325F 16HR AC	PLATE	0.05	3.00				1.82		
HP9-4-20	-----	FORGING	0.02	0.10-20.00			.242	2.99	30.7	490.
HP9-4-20(CEVM)	ANNEALED	FORGING	0.10	10.00-15.00				6.53	42.9	
HP9-4-30	-----	FORGING	0.02	0.10-20.00			.399	3.34	45.8	1883.
18NI(250)MAR	TUS=243KSI	BILLET	0.10	10.00			1.16	8.91	71.0	
300M	-----	FORGING	0.02	.10-20.00	.118		.749	3.87	117.	

TABLE 6.0.5

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/HT | PRODUCT FORM | SPECIMEN ORIENTATION | K_{ISCC} (Ksi√in) ENVIRONMENTS | | | | |
				SIMULATED SEA WATER	SEA WATER	DISTILLED WATER	3.5% NaCl	SUMP TANK WATER
D6AC	1550F AQ 650F 4HR	S	L-T			7.0		
	1550F AQ 950F 4HR	S	L-T			45.2		
HP9-4-.20	GTA Weld	P	---	65.0				
	Quenched and Tempered	P	---				110.0(2)	
	1525F 2HR OQ	P	L-T					105.0(1)
	-100F 2HR		T-L					97.4(5)
	1025F 4HR	FB	L-T					110.0
			T-L					107.0(2)
			S-T					78.3(3)
HP9-4-.45	475F	P	---				20.0	
H-11	Quenched and Tempered at 1100F	P	---				30.0	
12N1-5Cr-3Mo	Electric Furnace	P	---	40.0				
	GTA Welded	W	---	33.0				
	Low Residual	P	---	108.0				
	1550F,900F	P	L-S				80.0	
	20HR AC	P	T-S				70.0	
18N1(180)(MAR)	TYS=178 KSI	P	---	108.0				
	TYS=195 KSI	P	---				60.0	
	TYS=200 KSI	P	---				105.0	
18N1(200)(MAR)	TYS=215 KSI	P	---				70.0	
	Weld Center Line	P	L-S				70.0	
	1500F 1HR AC 900F 3HR	P	T-S				39.0	
	1675F 2HR AC 500F 0.25HR 850F 4HR/cool 250F/min	P	T-S				48.0	
		W	T-S				78.0	

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	SPECIMEN ORIENTATION	K_{ISCC}(Ksi√in) ENVIRONMENTS SIMULATED SEA WATER	SEA WATER	DISTILLED WATER	3.5% NaCl	SUMP TANK WATER
18N1(250)(MAR)	AGE 900F 3HR AC	P	L-S L-T				40.5(2) 45.0	
	TYS=250 KSI	P	--				50.0	
	TYS=260 KSI	P	--				70.0	
	1650F 1.25HR WQ 1525F 1.25HR WQ 900F 3HR AC	P	--	36.7				
18N1(280)(MAR)	1500F 1HR AC 900F 3HR	P	--				14.0	
18N1(300)(MAR)	AGED 900F 6HR	F	L-T T-L				7.0 6.0(2)	
	AGED 950F 12HR	F	T-L				6.0	
	Crack Prestressed to 50PCT KIC	F	T-L				5.0	
	Crack Prestressed to 25 PCT KIC	F	T-L				5.0	
	Crack Prestressed to 80 PCT KIC	F	T-L				10.0	
	1500F 0.5HR AC 900F 3HR	P	L-S			48.0(2)		
	1500F 2HR 800F 10HR	B	L-S			9.0		
	1700F,1500F AGED 900F 6HR	F	T-L				7.5	
	900F 3HR 950F 3HR	F	T-L				5.0	
18N1(350)(MAR)	AGE 800F 8HR	FB	--				5.0	
	AGE 900F 3HR	FB	--				10.0	
	AGE 900F 8HR	FB	--				10.0	

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/ HT | PRODUCT FORM | SPECIMEN ORIENTATION | K_{ISCC}(Ksi$\sqrt{in}$) ENVIRONMENTS | | | | |
				SIMULATED SEA WATER	SEA WATER	DISTILLED WATER	3.5% NaCl	SUMP TANK WATER
18Ni(350)(MAR)	1500F 1HR 800F 8HR	F	L-S				5.0	
	1500F 1HR 900F 8HR	F	L-S				10.0	
	1500F 1HR 950F 3HR	F	L-S				10.0	
300M	1500F 0.5HR OQ 400F 2+2HR (Coarse Grain)	P	--				12.0	
	1500F 0.5HR OQ 400F 2+2HR (Fine Grain)	P	--				12.0	
	1500F 0.5HR OQ 550F 2+2HR (Coarse Grain)	P	--				15.0	
	1500F 0.5HR OQ 550F 2+2HR (Fine Grain)	P	--				15.0	
	1550F 0.5HR OQ 400F 2+2HR (Coarse Grain)	P	--				15.0	
	1550F 0.5HR OQ 400F 2+2HR (Fine Grain)	P	--				15.0	
	1550F 0.5HR OQ 550F 2+2HR (Coarse Grain)	P	--				15.0	
	1550F 0.5HR OQ 550F 2+2HR (Fine Grain)	P	--				15.0	
	1600F 0.5HR OQ 400F 2+2HR (Coarse Grain)	P	--				12.0	
	1600F 0.5HR OQ 550F 2+2HR (Coarse Grain)	P	--				12.0	
	1600F 0.5HR OQ 550F 2+2HR (Fine Grain)	P	--				12.0	
	1650F,1600F 1HR OQ 600F 1+1HR	F	L-S				19.6	
	1700F 1.5HR AC 1600F 1.5HR OQ 600F 2+2HR	F	S-L					15.5(2)
	1710F,1610F 610F	B	L-T T-L				17.4(3) 17.6(4)	

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL
ALLOYS AT ROOM TEMPERATURE

ALLOY	CONDITION/ HT	PRODUCT FORM	SPECIMEN ORIENTATION	K_{ISCC} (Ksi$\sqrt{in}$) ENVIRONMENTS				
				SIMULATED SEA WATER	SEA WATER	DISTILLED WATER	3.5% NaCl	SUMP TANK WATER
4140	1700F 1600F OQ 750 1+1HR	P	---			15.0		
	1700F 1600F OQ 600F 1+1HR	P	---			11.0		
4330V	Quenched and Tempered at 500F	P	L-S				25.0	
4140	TYS=150 KSI	P	T-L		59.0			
	TYS=175 KSI	P	T-L		27.0			
	TYS=200 KSI	P	T-L		10.0			
	TYS=225 KSI	P	T-L		5.0			
	1350F OQ 750F 1.25HR	P	T-S		8.5			
	1550F OQ 750F Crack Prestressed to 80 PCT K_{Ic}	P	---				24.0	
	1550F OQ 750F Crack Prestressed to 60 PCT K_{Ic}	P	---				23.0	
	1550F OQ 750F Crack Prestressed to 40 PCT K_{Ic}	P	---				17.0	
	1550F OQ 750F Crack Prestressed to 20 PCT K_{Ic}	P	---				12.0	
	1550F OQ 750F 1HR	P	---				8.0	
	1575F OQ 675F 4HR	P	---			9.8		
	1575F OQ 800F 4HR	P	---			9.8		
	1600F 1HR OQ 600F 1+1HR	F	---				10.0	
	1650F 1HR AC 1680F 2HR OQ LN 0.25HR 400F 1+1HR OQ	B	L-T				15.0	

TABLE 6.0.5 (con't)

STRESS CORROSION CRACKING THRESHOLD DATA FOR STEEL ALLOYS AT ROOM TEMPERATURE

| ALLOY | CONDITION/HT | PRODUCT FORM | SPECIMEN ORIENTATION | K_{ISCC}(Ksi$\sqrt{in}$) ENVIRONMENTS | | | | |
				SIMULATED SEA WATER	SEA WATER	DISTILLED WATER	3.5% NaCl	SUMP TANK WATER
4340	1650F 1HR AC 1480F 2HR OQ LN 0.25HR 400F 1+1HR OQ	B	L-T				15.0	
	1700F 0.25HR AC 1550F OQ 600F 1+1HR	S	---				29.0	
	1800F Q 600F 1+1HR	F	L-S				25.2(12)	
4340 MOD	1650F 1HR 1600F 1HR OQ 1+1 600F (0.09 SI)	B	T-L				18.0	
	1650F 1HR 1600F 1HR OQ 1+1 400F (0.09 SI)	B	T-L				13.0	
	1800F Q 460F 1+1 HR (0.20C)	F	L-S				56.0	
	1800F Q 500F 1+1HR (0.21C)	F	L-S				52.0	
	1800F Q 600F 1 HR (0.20C)	F	L-S				72.0	
	1800F Q 650F 1HR (0.24C)	F	L-S				62.0	
	1800F Q 650F 1+1HR (0.28C)	F	L-S				35.0	
	1800F Q 700F 1HR (0.21C)	F	L-S				42.0	
	1800F Q 780F 1+1HR (0.33C)	F	L-S				32.0	
	1800F Q 800F 1HR (0.46C)	F	L-S				20.0	
	1800F Q 900F 1HR (0.64C)	F	L-S				30.0	
	1800F Q 925F 1+1HR (0.53C)	F	L-S				42.0	

TABLE 6.1.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL AF1410 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		

PLATE

CONDITION/HT	L-T	T-L	S-L
1650F 1HR. WQ. 1500F 1HR. WQ. 950F 5HRS. AC	139.6 ± 11.7 (2)	136.7 ± 7.4 (2)	-----

TABLE 6.1.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL AF1410

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

ENVIRONMENT LAB AIR
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))						
					2.5	5	10	20	50	100
1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	0.10-30.00	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)		0.10	0.63	3.60	30.7	139
1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	0.10-30.00			0.16	0.63	4.07	29.5	

TABLE 6.1.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL AF1410

ENVIRONMENT: LAB AIR AT R T

TEST CONDITIONS

SPECIMEN ORIENTATION: T-L

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	0.10-30.00			0.13	0.51	4.11	27.2	498
1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC	ROUND BAR	0.02	0.10-30.00				0.71	4.07	28.1	149

6.1-3

TABLE 6.1.2.1

ALLOY S1+FI AF1410 K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC	P	2.00	- 65	L-T	235.7	3.500	1.750	CT	---	0.54	109.90		1977	RI001
1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC	P	2.00 2.00	R.T	I-T	228.4 228.4	3.500 3.500	1.750 1.750	CT CT	--- ---	0.82 1.04	131.30 147.80	139.6/ 11.7	1977 1977	RI001 RI001
1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC	P	2.00	- 65	T-L	248.6	3.500	1.750	CT	---	0.49	111.10		1977	RI001
1650F 1HR, WQ, 1500F 1HR, WQ, 950F 5HRS, AC	P	2.00 2.00	R.T.	T-L	228.4 228.4	3.500 3.500	1.750 1.750	CT CT	--- ---	0.96 0.82	141.90 131.40	136.7/ 7.4	1977 1977	RI001 RI001

TABLE 6.1.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.1.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS
           AC
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.02			
DELTA K MIN	A: 3.88	.0513			
	B:				
	C:				
	D:				
	4.00	.0558			
	5.00	.102			
	6.00	.167			
	7.00	.252			
	8.00	.357			
	9.00	.485			
	10.00	.636			
	13.00	1.24			
	16.00	2.08			
	20.00	3.60			
	25.00	6.16			
	30.00	9.49			
	35.00	13.6			
	40.00	18.5			
	50.00	30.7			
	60.00	46.1			
	70.00	64.7			
	80.00	86.4			
	90.00	111.			
	100.00	139.			
	130.00	240.			
DELTA K MAX	A: 152.83	334.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	18.40

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	
	0.5-0.8	
	0.8-1.25	4
	1.25-2.0	
	>2.0	

CONDITION/HT: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
FORM: 4.25"TH ROUND BAR   YIELD STRENGTH:209.0- 222.0 KSI
SPECIMEN TYPE: WOL   ULT. STRENGTH: 243.0- 247.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.499- 0.506"
FREQUENCY: 0.10- 30.00 HZ   SPECIMEN WIDTH: 2.989- 3.006"
ENVIRONMENT: R.T., LAB AIR   REFERENCES:MA004

ALLOY
STEEL

AF1410

Figure 6.1.3.1

6.1-7

TABLE 6.1.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
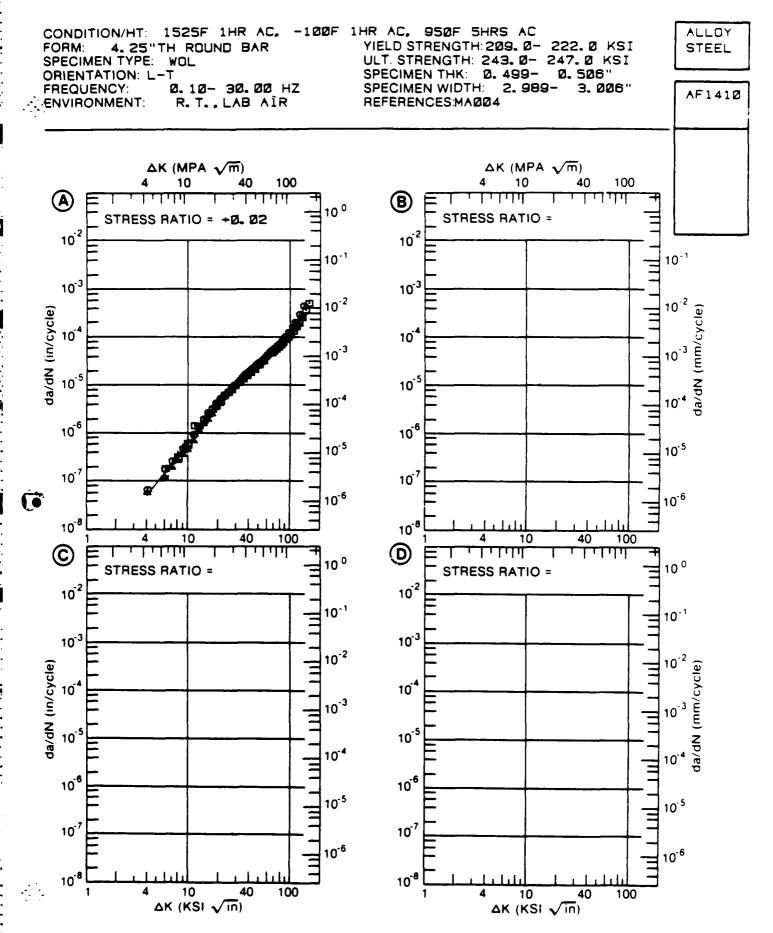
DATA ASSOCIATED WITH FIGURE 6.1.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS
         AC
ENVIRONMENT: R.T. , LAB AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.02			
A: 5.79	:	.117			
DELTA K B:	:				
MIN C:	:				
D:	:				
6.00	:	.134			
.7.00	:	.233			
8.00	:	.363			
9.00	:	.525			
10.00	:	.717			
13.00	:	1.46			
16.00	:	2.44			
20.00	:	4.07			
25.00	:	6.60			
30.00	:	9.66			
35.00	:	13.3			
40.00	:	17.5			
50.00	:	28.1			
60.00	:	42.0			
70.00	:	60.1			
80.00	:	83.1			
90.00	:	112.			
100.00	:	149.			
130.00	:	320.			
A: 135.83	:	368.			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE	13.68
PERCENT ERROR	

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	4
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1525F 1HR AC. -100F 1HR AC. 950F 5HRS AC
FORM: 4.25"TH ROUND BAR   YIELD STRENGTH:211.0- 221.0 KSI
SPECIMEN TYPE: WOL   ULT. STRENGTH: 243.0- 249.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.498- 0.506"
FREQUENCY: 0.10- 30.00 HZ SPECIMEN WIDTH: 2.979- 2.995"
ENVIRONMENT: R.T..LAB AIR   REFERENCES:MA004

ALLOY STEEL

AF1410

Figure 6.1.3.2

6.1-9

TABLE 6.1.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
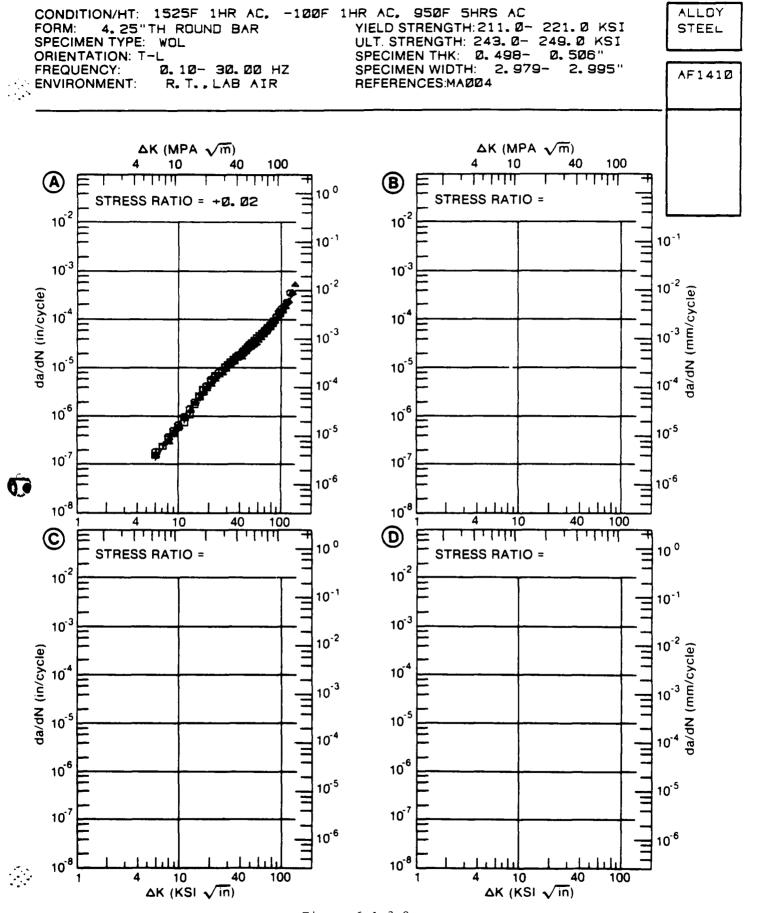
DATA ASSOCIATED WITH FIGURE 6.1.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS
           AC
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.02			
A: 3.95	:	.08			
DELTA K B: 5	:				
MIN C:	:				
D:	:				
4.00	:	.0906			
5.00	:	.164			
6.00	:	.194			
7.00	:	.237			
8.00	:	.322			
9.00	:	.452			
10.00	:	.633			
13.00	:	1.45			
16.00	:	2.50			
20.00	:	4.07			
25.00	:	6.31			
30.00	:	8.97			
35.00	:	12.3			
40.00	:	16.6			
50.00	:	29.5			
60.00	:	52.4			
70.00	:	93.5			
80.00	:	167.			
90.00	:	289.			
A: 96.86	:	395.			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	9.95

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS AC
FORM: 4.50"TH ROUND BAR   YIELD STRENGTH: 212.0 KSI
SPECIMEN TYPE: WOL   ULT. STRENGTH: 240.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.501"
FREQUENCY: 0.10- 30.00 HZ   SPECIMEN WIDTH: 2.981- 2.983"
ENVIRONMENT: R.T., LAB AIR   REFERENCES: MA004

ALLOY
STEEL

AF1410

Figure 6.1.3.3

6.1-11

TABLE 6.1.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
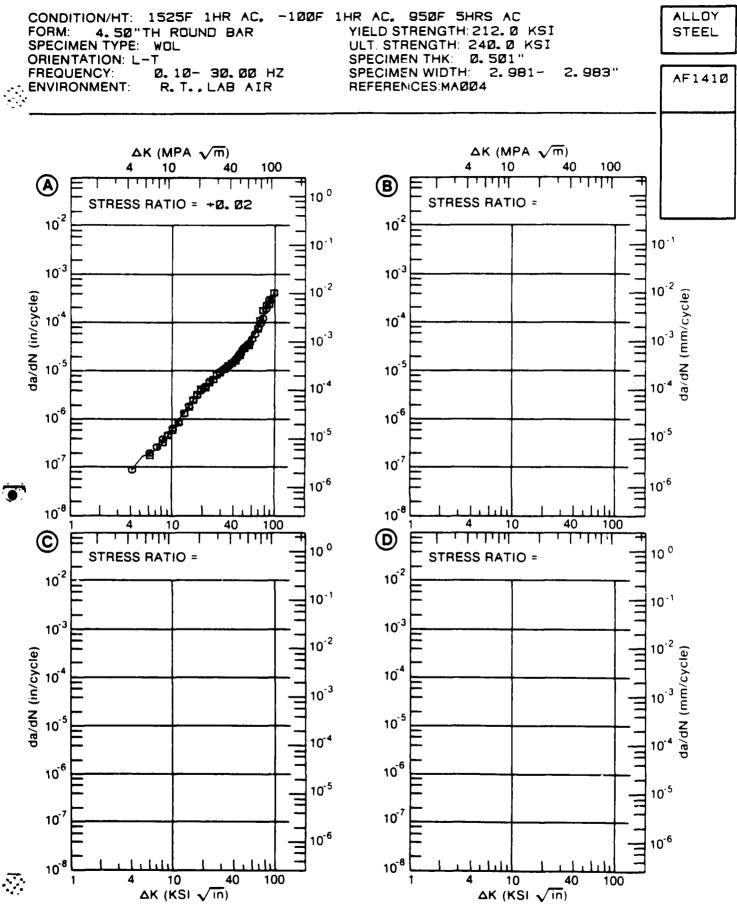
DATA ASSOCIATED WITH FIGURE 6.1.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   AF1410
CONDITION: 1525F 1HR AC, -100F 1HR AC, 950F 5HRS
         AC
ENVIRONMENT: R.T. ,LAB AIR

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)					
		A	B	C	D
		R=+0.02			
A: 3.92		.071			
DELTA K B: 6					
MIN C:					
D:					
4.00		.0762			
5.00		.134			
6.00		.187			
7.00		.242			
8.00		.308			
9.00		.393			
10.00		.513			
13.00		1.23			
16.00		2.37			
20.00		4.11			
25.00		6.47			
30.00		9.07			
35.00		12.1			
40.00		15.9			
50.00		27.2			
60.00		46.9			
70.00		82.7			
80.00		148.			
90.00		270.			
100.00		498.			
A: 110.17		934.			
DELTA K B:					
MAX C:					
D:					

| ROOT MEAN SQUARE | 6.95 |
| PERCENT ERROR | |

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1525F 1HR AC. -100F 1HR AC. 950F 5HRS AC
FORM: 4.50"TH ROUND BAR   YIELD STRENGTH:214.0 KSI
SPECIMEN TYPE: WOL   ULT. STRENGTH: 243.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.500- 0.505"
FREQUENCY: 0.10- 30.00 HZ   SPECIMEN WIDTH: 2.983- 2.984"
ENVIRONMENT: R.T.,LAB AIR   REFERENCES:MA004

ALLOY
STEEL

AF1410

Figure 6.1.3.4

6.1-13

TABLE 6.2.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS
           AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR 30HZ	E= R.T. S.T.W. 1-30HZ		
DELTA K MIN A:	8.60	.409			
DELTA K MIN B:	13.62		2.29		
MIN C:					
D:					
	9.00	.471			
	10.00	.646			
	13.00	1.34			
	16.00	2.28	3.40		
	20.00	3.88	5.49		
	25.00	6.39	8.40		
	30.00	9.45	11.7		
	35.00	13.1	15.4		
	40.00	17.2	19.8		
	50.00	27.3	31.1		
	60.00	39.9	47.4		
DELTA K MAX A:	65.69	48.3			
DELTA K MAX B:	62.59		52.7		
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR		4.86	9.34		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	2		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				
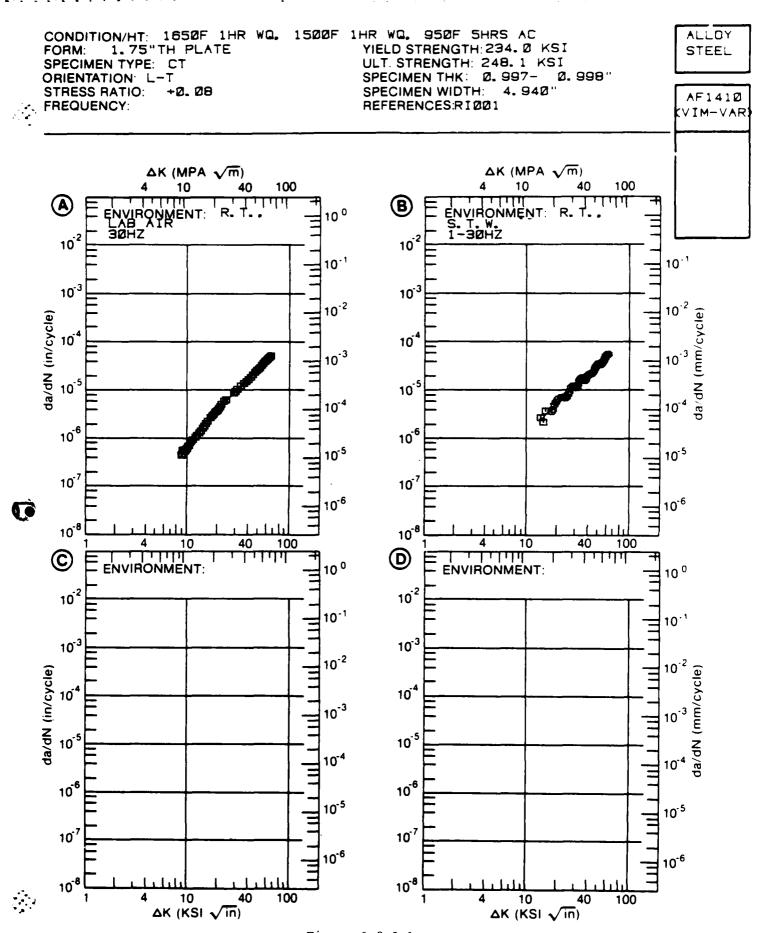
6.2-2

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE   YIELD STRENGTH:234.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 248.1 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.997- 0.998"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 4.940"
FREQUENCY: REFERENCES:RI001

ALLOY
STEEL

AF1410
(VIM-VAR)

Figure 6.2.3.1

TABLE 6.2.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS
          AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=- 65F AIR 30HZ	E= R.T. LAB AIR 1-30HZ	E= R.T. 3.5% NACL 1-30HZ	
DELTA K MIN	A: 11.30	.684			
	B: 9.31		.575		
	C: 15.28			2.78	
	D:				
	10.00		.711		
	13.00	.947	1.45		
	16.00	1.53	2.40	3.09	
	20.00	2.55	3.95	4.97	
	25.00	4.23	6.37	7.57	
	30.00	6.33	9.36	10.5	
	35.00	8.85	13.0	14.0	
	40.00	11.8	17.5	18.1	
	50.00		29.3	29.5	
	60.00		46.5	47.1	
	70.00		71.1	74.5	
	80.00		106.		
	90.00		154.		
DELTA K MAX	A: 49.56	18.3			
	B: 93.58		176.		
	C: 70.51			76.2	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		4.10	9.36	16.05	
LIFE	0.0-0.5				
PREDICTION	0.5-0.8			1	
RATIO	0.8-1.25	1	3	2	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

6.2-4

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 234.0- 240.0 KSI
ULT. STRENGTH: 247.8- 258.2 KSI
SPECIMEN THK: 0.997- 1.002"
SPECIMEN WIDTH: 4.940- 4.950"
REFERENCES: RI001

ALLOY
STEEL

AF1410
(VIM-VAR)

Figure 6.2.3.2

6.2-5
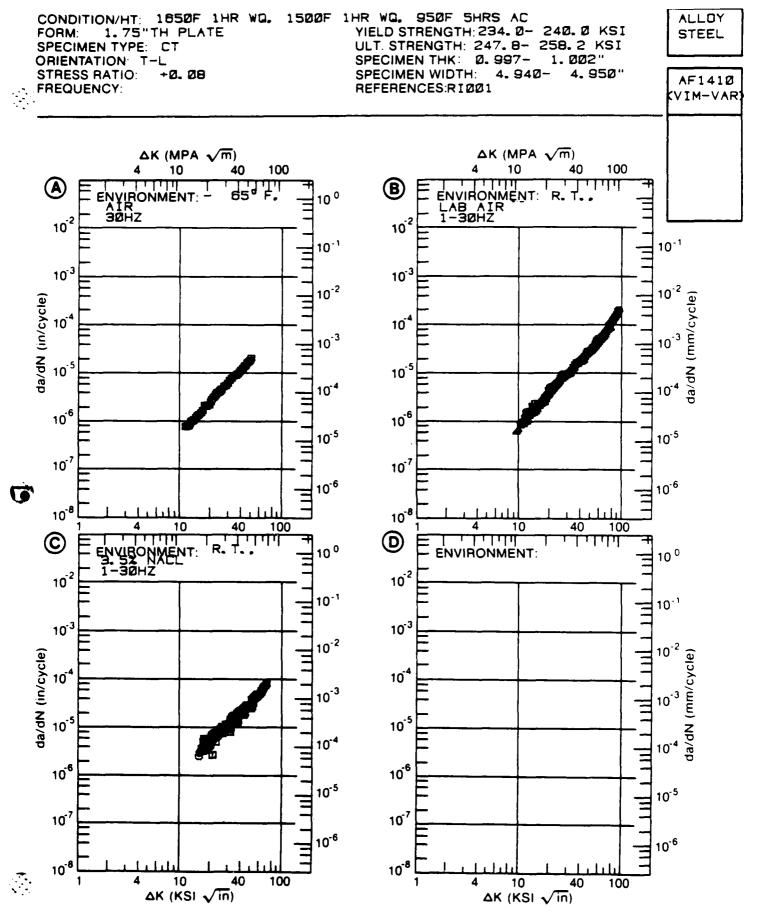
TABLE 6.2.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.2.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   AF1410(VIM-VAR)
CONDITION: 1650F 1HR WQ, 1500F 1HR WQ, 950F 5HRS
           AC

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. LAB AIR 10-30HZ	E= R.T. 3.5% NACL 1-30HZ		
A: 8.38	:	.683			
DELTA K B: 19.33	:		5.72		
MIN C:	:				
D:	:				
9.00	:	.835			
10.00	:	1.11			
13.00	:	2.11			
16.00	:	3.36			
20.00	:	5.35	6.08		
25.00	:	8.40	8.95		
30.00	:	12.1	12.9		
35.00	:	16.6	18.9		
40.00	:	22.0	25.5		
50.00	:	36.1	37.8		
60.00	:	56.1			
A: 68.03	:	77.7			
DELTA K B: 56.41	:		52.5		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	5.74	12.24

LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	1
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

CONDITION/HT: 1650F 1HR WQ. 1500F 1HR WQ. 950F 5HRS AC
FORM: 1.75"TH PLATE   YIELD STRENGTH:234.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 247.8 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.998"
STRESS RATIO: +0.30   SPECIMEN WIDTH: 4.940"
FREQUENCY: REFERENCES:RI001

ALLOY
STEEL

AF1410
(VIM-VAR)

Figure 6.2.3.3

6.2-7
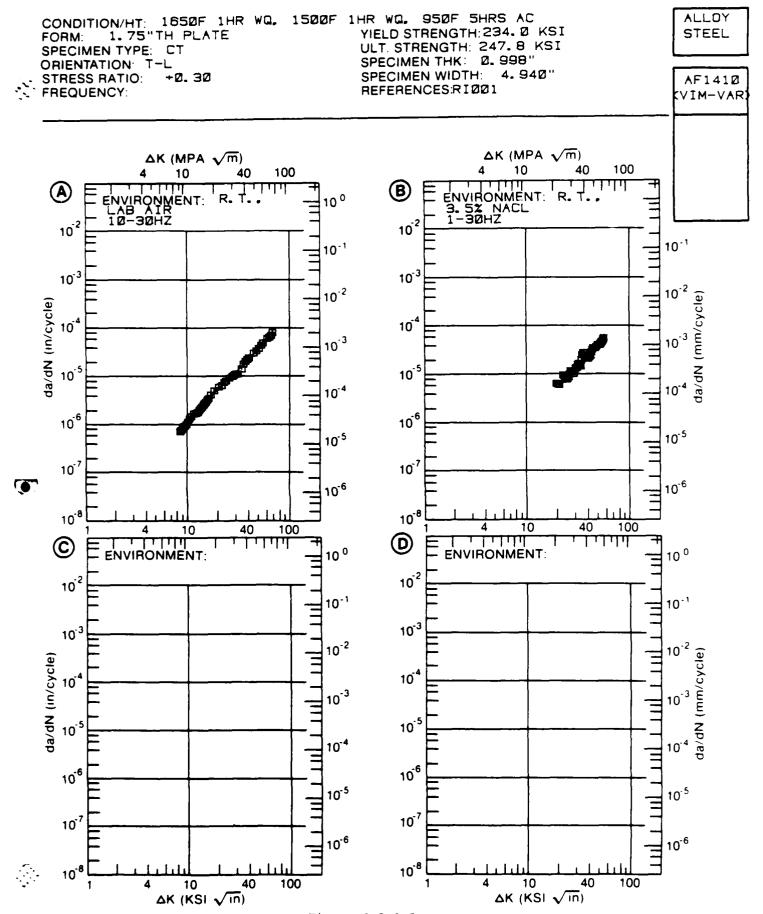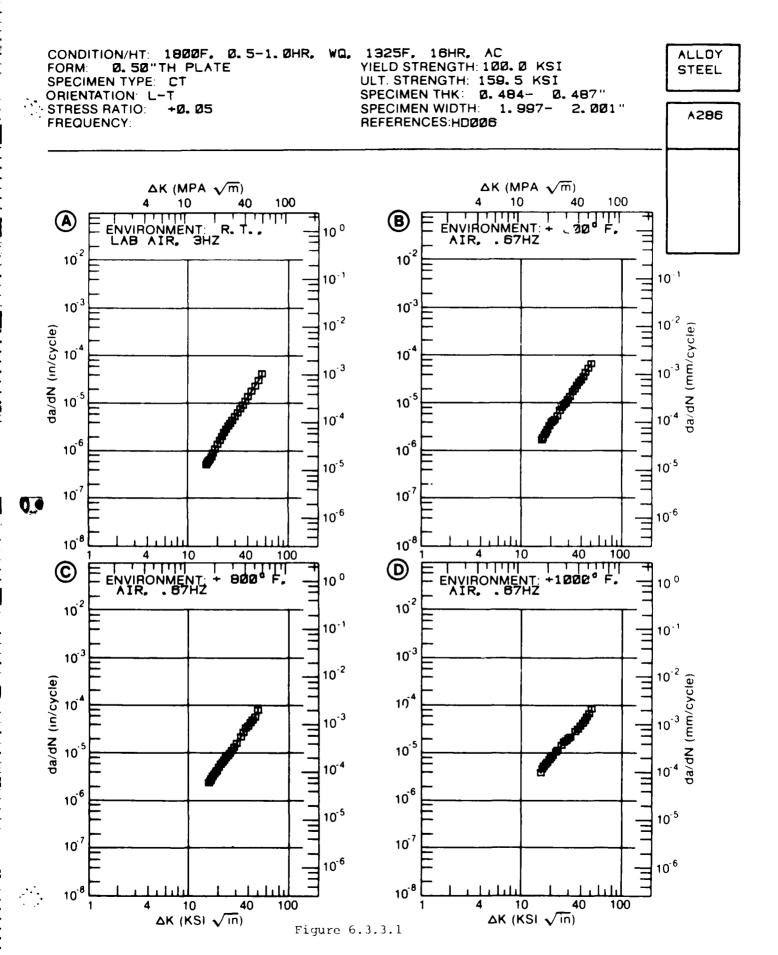
TABLE 6.3.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR, 3HZ	E=+ 600F AIR, .67HZ	E=+ 800F AIR, .67HZ	E=+1000F AIR, .67HZ
DELTA K MIN	A: 14.92	.474			
	B: 15.66		1.70		
	C: 15.62			2.39	
	D: 15.26				3.96
	16.00	.650	1.84	2.57	4.66
	20.00	1.59	3.94	5.01	8.86
	25.00	3.43	7.96	9.68	14.7
	30.00	6.09	13.9	16.7	21.6
	35.00	9.79	22.2	26.6	30.5
	40.00	14.9	33.8	40.1	42.8
	50.00	31.5			
DELTA K MAX	A: 53.83	41.2			
	B: 48.91		66.5		
	C: 48.76			75.7	
	D: 49.18				82.1
ROOT MEAN SQUARE PERCENT ERROR		4.21	3.95	4.12	2.90

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC
FORM: 0.50"TH PLATE   YIELD STRENGTH: 100.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 159.5 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.484- 0.487"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 1.997- 2.001"
FREQUENCY: REFERENCES: HD006

ALLOY
STEEL

A286

Figure 6.3.3.1

TABLE 6.3.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR, 3HZ	E=+ 600F AIR, .67HZ	E=+ 800F AIR, .67HZ	E=+1000F AIR, .67HZ
A:	15.19	.638			
DELTA K B:	16.25		2.02		
MIN C:	16.59			1.93	
D:	15.89				6.04
	16.00	.785			6.12
	20.00	1.82	3.69	3.54	9.69
	25.00	3.86	7.06	6.89	15.7
	30.00	6.76	12.3	11.7	24.1
	35.00	10.5	20.3	18.3	36.2
	40.00	15.0	32.3	27.5	53.5
	50.00		76.6	57.6	
A:	45.10	20.4			
DELTA K B:	52.49		94.0		
MAX C:	54.51			78.9	
D:	48.72				104.

ROOT MEAN SQUARE PERCENT ERROR	4.62	5.51	6.21	3.93

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1800F. 0.5-1.0HR. WQ. 1325F. 16HR. AC
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.05
FREQUENCY:

YIELD STRENGTH:100.0 KSI
ULT. STRENGTH: 159.5 KSI
SPECIMEN THK: 0.486- 0.488"
SPECIMEN WIDTH: 1.999- 2.002"
REFERENCES:HD006

ALLOY
STEEL

A286

Figure 6.3.3.2

6.3-5
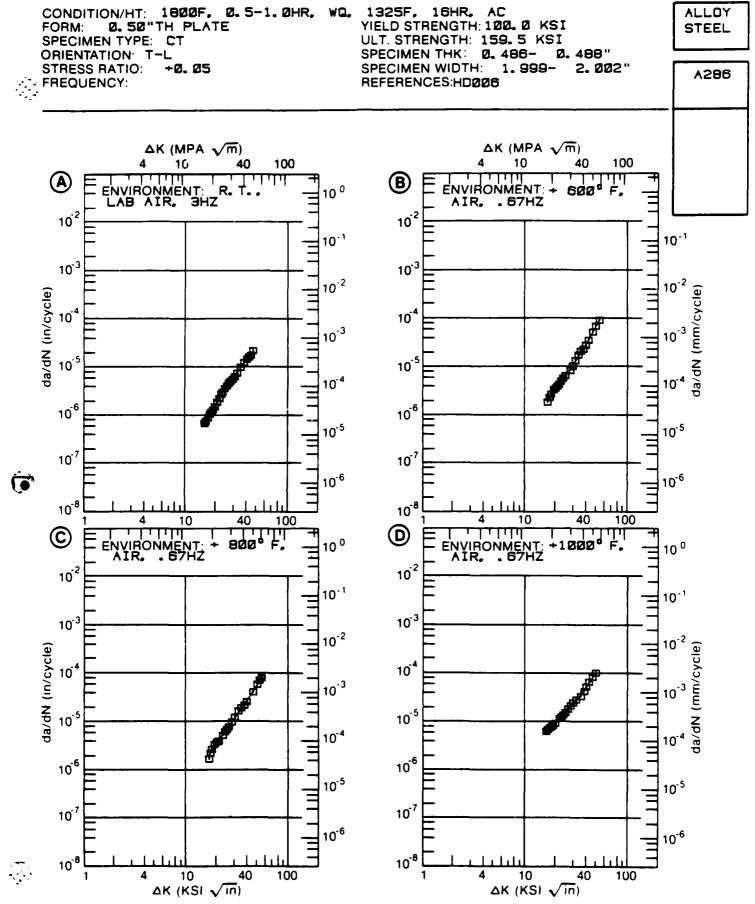
TABLE 6.3.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   A286
CONDITION: 1800F, 0.5-1.OHR, WQ, 1325F, 16HR, AC

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	E=+1000F : AIR			
DELTA K A: MIN B: C: D:				
200.00				
DELTA K A: MAX B: C: D:				

ROOT MEAN SQUARE PERCENT ERROR	0.00

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC
FORM: 1.50"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: R-L
STRESS RATIO: +0.05
FREQUENCY: 0.67 HZ

YIELD STRENGTH: 136.4 KSI
ULT. STRENGTH: 188.3 KSI
SPECIMEN THK: 0.290"
SPECIMEN WIDTH: 1.153"
REFERENCES: HD006

ALLOY
STEEL

A286
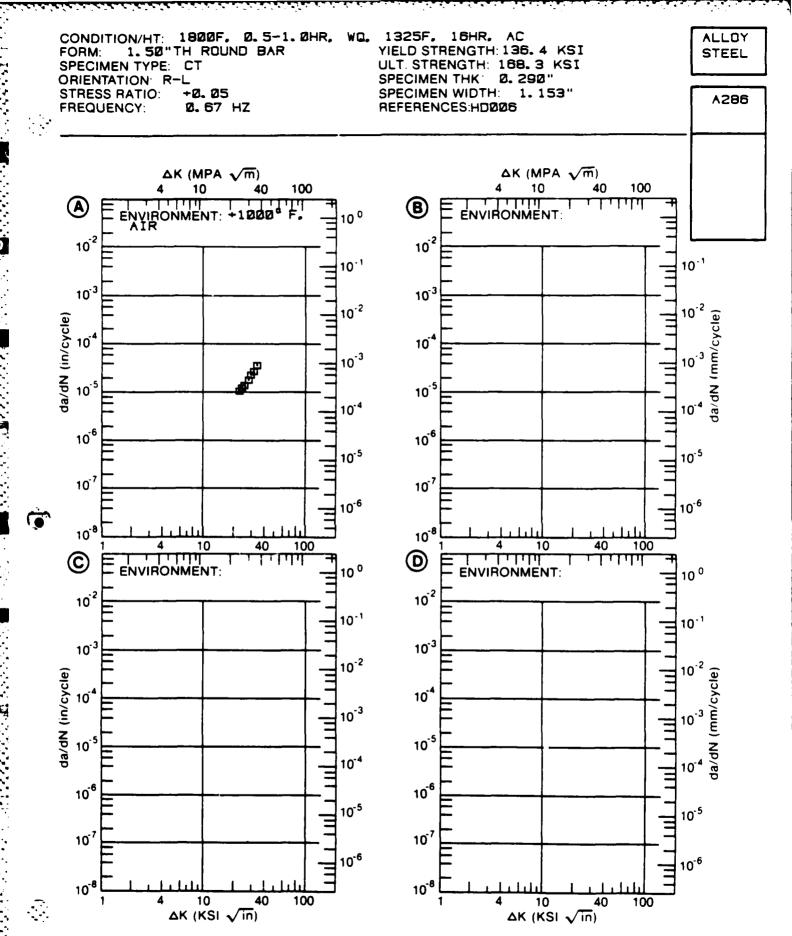
Figure 6.3.3.3

TABLE 6.3.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.3.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   A286
CONDITION: 1800F, 0.5-1.0HR, WQ, 1325F, 16HR, AC

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. LAB AIR, 3HZ	E=+ 600F AIR, .67HZ		
DELTA K MIN A: B: C: D:	:				
200.00	:				
DELTA K MAX A: B: C: D:	:				

ROOT MEAN SQUARE PERCENT ERROR	0.00	0.00

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1800F. 0.5-1.0HR. WQ. 1325F. 16HR. AC
FORM: 1.50"TH ROUND BAR   YIELD STRENGTH: 136.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 168.3 KSI
ORIENTATION: R-C   SPECIMEN THK: 0.401- 0.403"
STRESS RATIO: +0.05   SPECIMEN WIDTH: 0.795- 0.804"
FREQUENCY: REFERENCES:HD006
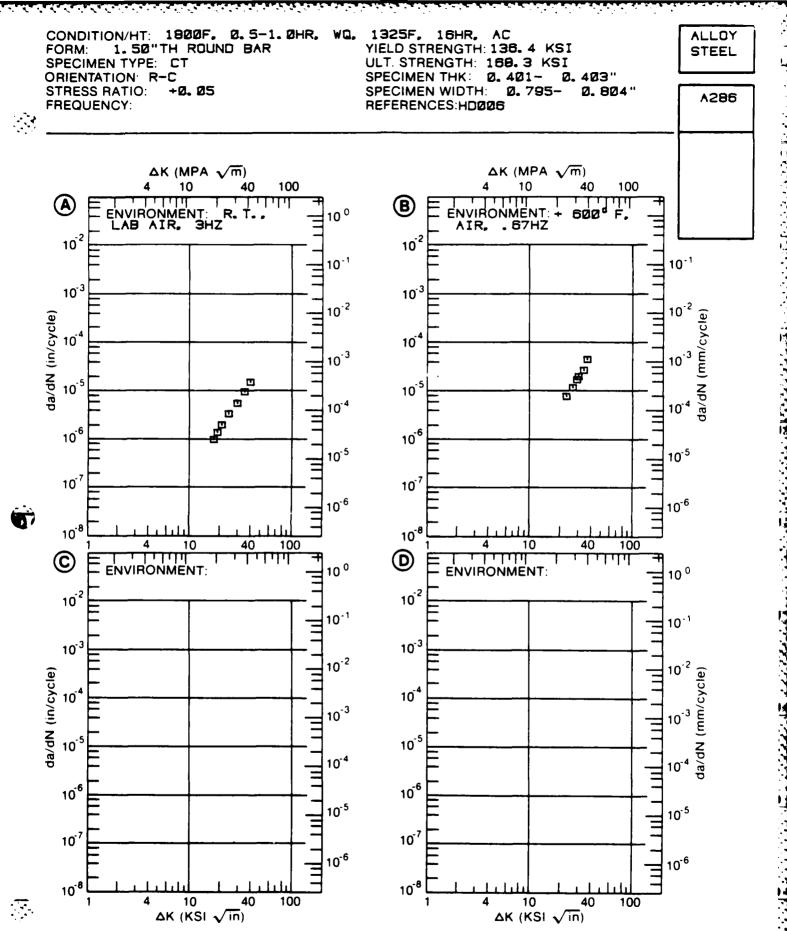
Figure 6.3.3.4

TABLE 6.4.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL D6AC AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS)		
	L-T	T-L	S-L
PLATE			
HEAT TREATED TO 46 RC HARDNESS	------	85.8 ± 1.8 (2)	------
1650F AUS-BAY QUENCH 975F,8Q 325F,1000F 2+2 HR	66.9 ±18.7 (7)	------	------
1650F AUS-BAY QUENCH 975F,8Q 375F,1000F 2+2 HR	62.2 ±14.0 (19)	------	------
1650F,AUS-BAY QUENCH 975F,8Q 400F,1000F 2+2 HR	64.4 ±12.1 (103)	------	------
1700F,AUS-BAY QUENCH 975F,DQ 140F,1000F 2+2 HR	92.0 ± 8.2 (30)	------	------
CONDITION/HT	L-T	T-L	S-L
FORGING			
1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR	------	78.4 ±15.1 (6)	83.9 ±14.8 (52)
1650F AUS-BAY QUENCH 975F,8Q 375F,1000F 2+2 HR	46.0 ± 4.2 (8)	------	------

TABLE 6.4.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL D6AC AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN))	(NUMBER OF SPECIMENS)		
		L-T	T-L	S-L

FORGING

CONDITION/HT	L-T	T-L	S-L
1650F, AUS-BAY QUENCH 975F, BQ 400F, 1000F 2+2 HR	66.2 ±12.3 (53)	----	----
1700F, AUS-BAY QUENCH 975F, DQ 140F, 1000F 2+2 HR	95.2 ± 6.4 (34)	----	----

BILLET

CONDITION/HT	L-T	T-L	S-L
1650F, 1 HR, FC 1650F 1 HR, DQ, 1025F 2+2 HR	78.5 ± 4.7 (2)	----	----
1650F, 1 HR, FC TO 960F, DQ AT 150F, AC, 1000F 2+2 HR	80.3 ± 0.8 (2)	----	----
1700F, 1 HR, FC TO 960F, DQ AT 150F, AC, 1000F 2+2 HR	80.3 ± 4.3 (3)	----	----
1700F, 1 HR, DQ, 1025F 2+2 HR	77.3 ± 2.6 (6)	----	----
1725F 1 HR, AC 1700F 1 HR, DQ, 1000F 1 HR, 1015F 1 HR	77.2 ± 2.7 (3)	----	----
1725F, 1 HR, AC 1700F 1 HR, DQ, 1100F 2+2 HR	101.2 ± 6.1 (6)	----	----

TABLE 6.4.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL D6AC AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		

BILLET

CONDITION/HT	L-T	L-L	S-L
1725F, 1 HR, AC 1700F 1 HR, OQ. 1025F 2+2 HR	74.4 ± 6.2 (6)	----	----
1725F, 1 HR, AC 1650F 1 HR, FC TO 960F, SQ 350F 0.5 HR, AC 1025F 2+2 HR	75.1 ±10.1 (3)	----	----

TABLE 6.4.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION	L-T	ENVIRONMENT	DRY AIR AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.09	0.10					5.58		
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.09	1.00					5.24		
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.09	3.00					5.43		
1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR	PLATE	0.10	0.10					5.28	43.9	
1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR	PLATE	0.10	1.00					5.88	43.4	
1700F A-BQ AT 975F, OQ AT 1400F, 1000F 2+2HR	PLATE	0.10	3.00					4.86	43.3	
1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS	PLATE	0.50	0.10- 3.00					6.18		

TABLE 6.4.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT: LAB AIR
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.10	0.10						65.2	
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.10	1.00					2.85		
1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR	PLATE	0.50	1.00					9.29		
1700F A-BQ AT 975F, DQ AT 140F, 1000F 2+2HR	PLATE	0.10	1.00					5.61	51.3	

TABLE 6.4.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: JP-4 FUEL AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	PLATE	0.10	0.10				10.4		
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	PLATE	0.10	1.00				7.44		
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	PLATE	0.10	3.00			0.73	5.31		
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	PLATE	0.50	1.00			2.14	9.06		
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	PLATE	0.50	3.00			1.09	6.45		
1650F A-BQ AT 975F, SQ AT 375F. 1000F 2+2HR	FORGING	0.10	1.00			0.47	6.36		
1650F A-BQ AT 975F, SQ AT 400F. 1000F 2+2HR	FORGING	0.50	1.00				5.38		

6.4-6

TABLE 6.4.1.4 (Con't)

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN ORIENTATION	L-T	ENVIRONMENT	JP-4 FUEL AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2 5	5	10	20	50	100
1700F A-BQ AT 975F, OQ AT 140F. 1000F 2+2HR	PLATE	0 50	1 00					8 95		
1700F A-BQ AT 975F, OQ AT 140F. 1000F 2+2HR	PLATE	0 50	3 00					6 73		
1700F A-BQ AT 975F, OQ AT 140F. 1000F 2+2HR	FORGING	0 10	0 10					14 8	87 6	
1700F A-BQ AT 975F, OQ AT 140F. 1000F 2+2HR	FORGING	0 10	1 00					8 37	37 4	
1700F A-BQ AT 975F, OQ AT 140F. 1000F 2+2HR	FORGING	0 10	3 00					3 73	38 7	

TABLE 6.4.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

ENVIRONMENT DIST H20 AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))						
				2 5	5	10	20	50	100	
				FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)						
1650F A-BQ AT 975F. SQ AT 375F. 1000F 2+2HR	FORGING	0.10	1.00			9.32	7.55			
1650F A-BQ AT 975F. SQ AT 375F. 1000F 2+2HR	FORGING	0.50	1.00				13.9			
1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR	PLATE	0.50	1.00			2.33	12.2			
1700F A-BQ AT 975F. OQ AT 100F. 1000F 2+2HR	PLATE	0.50	3.00			1.43	8.56			
1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR	PLATE	0.11	0.10				23.4			
1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR	PLATE	0.11	1.00				10.7			
1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR	PLATE	0.11	3.00				5.88			

TABLE 6.4.1.5 (Con't)

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL D6AC

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT: DIST H2O
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))					
				FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	10	20	50	100
1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR	FORGING	0.10	0.10				15.7		
1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR	FORGING	0.10	1.00				9.51		
1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR	FORGING	0.10	3.00				6.47		
1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR	FORGING	0.48	1.00				11.4		

TABLE 6.4.2.1

ALLOY STEEL — D6AC — K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
HEAT TREATED TO 46 RC HARDNESS	F	---	R T	T-L	206.0	1.401	0.700	NB	0.711	0.42	84.50			1971	84029
		---			206.0	1.400	0.700	NB	0.717	0.45	87.00	85.8/	1.8	1971	84029
1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR	F	---	R T	L-S	197.9	2.000	1.006	CT	1.046	0.28	67.37			1979	MD001
		---			198.0	2.000	1.001	CT	1.061	0.29	68.26			1979	MD001
		---			199.8	1.997	1.001	CT	1.041	0.21	58.33	64.7/	5.5	1980	MD001
1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR	F	---	R.T.	T-L	198.1	2.001	1.003	CT	1.048	0.33	72.62			1979	MD001
		---			198.1	2.000	1.005	CT	1.072	0.55	93.00			1979	MD001
		---			198.5	2.000	1.005	CT	1.069	0.55	93.67			1979	MD001
		---			198.5	2.000	1.001	CT	1.060	0.49	87.89			1979	MD001
		---			207.5	1.998	1.002	CT	1.024	0.20	59.04			1980	MD001
		---			207.5	1.997	1.000	CT	1.035	0.23	64.27	78.4/	15.1	1980	MD001
1615F 2.25HR, A-BQ 325F, AC, 310-345F 3HR, 1080F 6-6.5HR	F	---	R T	S-L	186.7	1.999	1.005	CT	1.042	0.71	99.54			1978	MD001
		---			186.7	2.000	1.005	CT	1.030	0.36	71.78			1978	MD001
		---			186.7	2.000	1.005	CT	1.045	0.55	88.32			1978	MD001
		---			187.2	1.987	0.996	CT	1.040	0.76	103.67			1979	MD001
		---			187.2	1.989	0.996	CT	1.003	0.81	106.64			1978	MD001
		---			187.2	1.990	1.002	CT	1.021	0.76	103.25			1978	MD001
		---			189.5	1.992	0.994	CT	1.016	0.63	95.25			1978	MD001
		---			189.5	1.996	0.995	CT	1.034	0.61	93.78			1978	MD001
		---			189.5	1.994	0.994	CT	1.023	0.63	95.37			1978	MD001
		---			189.5	1.997	0.973	CT	1.033	0.31	67.12			1978	MD001
		---			189.5	1.996	1.003	CT	1.024	0.35	71.23			1978	MD001
		---			189.5	1.993	0.994	CT	1.012	0.34	70.02			1978	MD001
		---			191.0	2.001	0.990	CT	1.028	0.37	73.64			1979	MD001
		---			191.0	1.995	0.972	CT	1.021	0.43	81.67			1979	MD001
		---			191.0	2.002	0.991	CT	1.027	0.46	82.63			1979	MD001
		---			191.9	1.988	1.003	CT	1.033	0.57	92.34			1978	MD001
		---			191.9	1.996	1.003	CT	1.043	0.54	89.64			1978	MD001
		---			191.9	1.974	1.002	CT	1.035	0.50	86.37			1978	MD001
		---			192.8	2.004	0.991	CT	1.015	0.18	53.02			1979	MD001
		---			192.8	2.000	0.991	CT	1.019	0.17	51.11			1979	MD001
		---			192.8	2.000	0.991	CT	1.037	0.16	48.96			1979	MD001

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   DGAC   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN / STAN DEV	DATE	REFER
1650F 2.25HR, A.RQ 325F AC, DIG 345F 3HR, 1080F 6.6 5HR	F	-	R T	S-L	193.0	2.000	1.000	CT	1.044	0.34	71.92		1979	MD001
					193.0	1.999	0.965	CT	1.023	0.54	89.71		1979	MD001
					193.8	2.000	0.992	CT	1.024	0.30	68.14		1977	MD001
					193.8	2.000	1.001	CT	1.049	0.31	69.12		1977	MD001
					193.8	1.978	1.000	CT	1.031	0.27	64.19		1978	MD001
					194.1	2.001	0.997	CT	1.036	0.61	96.00		1980	MD001
					194.1	1.999	0.999	CT	1.076	0.41	78.90		1980	MD001
					194.1	1.997	0.996	CT	1.037	0.47	84.17		1978	MD001
					194.4	1.998	1.000	CT	1.026	0.43	80.69		1977	MD001
					194.5	2.000	1.004	CT	1.050	0.55	91.67		1979	MD001
					194.5	2.000	1.004	CT	1.062	0.55	91.59		1979	MD001
					195.5	1.999	1.002	CT	1.057	0.30	68.54		1979	MD001
					195.5	2.000	1.004	CT	1.025	0.29	67.40		1979	MD001
					196.3	1.997	1.003	CT	1.057	0.45	83.50		1978	MD001
					196.3	2.000	1.005	CT	1.040	0.55	92.69		1977	MD001
					196.3	1.978	1.000	CT	1.045	0.36	75.10		1979	MD001
					196.9	2.001	1.002	CT	1.058	0.60	96.67		1978	MD001
					196.9	1.999	1.002	CT	1.011	0.65	101.04		1978	MD001
					196.9	1.999	1.007	CT	1.017	0.67	102.31		1978	MD001
					200.2	1.999	1.002	CT	1.034	0.63	99.31		1978	MD001
					200.2	1.999	1.007	CT	1.014	0.38	78.63		1978	MD001
					200.2	1.999	1.007	CT	1.025	0.35	75.67		1978	MD001
					201.5	1.997	1.007	CT	1.027	0.35	75.91		1978	MD001
					201.5	1.997	0.979	CT	1.037	0.67	104.62		1978	MD001
					201.5	1.997	0.999	CT	1.052	0.60	99.19		1978	MD001
					202.3	2.001	1.000	CT	1.036	0.65	103.07		1977	MD001
					202.3	2.000	0.999	CT	1.042	0.55	95.58		1977	MD001
					202.3	2.003	1.000	CT	1.042	0.56	95.80		1977	MD001
					202.7	2.000	1.002	CT	1.038	0.55	95.21		1980	MD001
					202.7	1.995	1.001	CT	1.037	0.32	73.46		1980	MD001
									1.037	0.25	65.34	83.9 / 14.8		
1650F AUS-BAY QUENCH 975F 5Q 325F 1000F 345 HR	P	1.50	-65	L-T	228.0	1.499	0.750	CT	0.760	0.06	35.80		1972	82343
		0.00			228.0	1.502	0.757	CT	0.759	0.11	47.00		1972	82343
		1.50			228.0	1.501	0.750	CT	0.790	0.05	31.20	37.0 / 6.9	1972	82343
		1.50			228.0	1.499	0.750	CT	0.854	0.05	34.10		1972	82343

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	PRIOR THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	$2.5*(K(IC)/TYS)^2$ (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN/STAN DEV	DATE	REFER
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	F	1 50	-40	L-T	227.0	1.500	0.750	CT	0.771	0.05	32.00		1972	82543
		1 50			227.0	1.502	0.750	CT	0.781	0.06	36.10	34.1/ 2.9	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	0 80	-20	L-T	226.0	1.503	0.757	CT	0.765	0.15	34.60		1972	82543
		1 50			226.0	1.479	0.749	CT	0.811	0.06	34.50		1972	82543
		1 50			226.0	1.500	0.750	CT	0.786	0.06	34.60		1972	82543
		0 80			226.0	1.502	0.757	CT	0.769	0.15	55.70		1972	82543
		1 50			226.0	1.500	0.750	CT	0.777	0.07	37.20	43.3/ 10.9	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	0	L-T	224.0	1.499	0.750	CT	0.789	0.10	43.60		1972	82543
		1 50			224.0	1.479	0.750	CT	0.784	0.08	40.70		1972	82543
		1 50			224.0	1.477	0.750	CT	0.817	0.08	39.60	42.0/ 3.2	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	20	L-T	222.0	1.503	0.750	CT	0.768	0.10	44.60		1972	82543
		1 50			222.0	1.500	0.750	CT	0.837	0.08	39.60		1972	82543
		1 50			222.0	1.477	0.750	CT	0.780	0.06	35.80	40.0/ 4.4	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	40	L-T	220.0	1.499	0.751	CT	0.787	0.13	50.00		1972	82543
		1 50			220.0	1.503	0.750	CT	0.777	0.08	38.70		1972	82543
		1 50			220.0	1.502	0.748	CT	0.815	0.11	45.50	44.7/ 5.7	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	R T	L-T	217.0	1.498	0.755	CT	0.790	0.13	48.70		1972	82543
		0 80			217.0	1.504	0.757	CT	0.767	0.35	81.00		1972	82543
		0 80			217.0	1.502	0.757	CT	0.750	0.34	80.10		1972	82543
		0 80			217.0	1.502	0.755	CT	0.765	0.37	83.60		1972	82543
		1 50			217.0	1.501	0.755	CT	0.815	0.12	46.50		1972	82543
		1 50			217.0	1.502	0.756	CT	0.777	0.11	45.80		1972	82543
		0 80			217.0	1.499	0.750	CT	0.769	0.36	82.70	66.9/ 18.7	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	175	L-T	211.0	1.497	0.750	CT	0.768	0.32	76.30		1972	82543
		1 50			211.0	1.502	0.750	CT	0.823	0.32	73.40		1972	82543
		1 50			211.0	1.498	0.750	CT	0.763	0.30	72.50	74.7/ 2.0	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 325F,1000F 2+2 HR	P	1 50	300	L-T	204.0	1.496	0.751	CT	0.763	0.61	100.80		1972	82543

TABLE 6.4.2.1 (Con't)

CONDITION	PRODUCT FORM	TEST THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN/STAN DEV	DATE	REFER
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	P	1.50	300	L-T	204.0	1.501	0.750	CT	0.798	0.67	105.40		1972	82543
		1.50			204.0	1.503	0.750	CT	0.772	0.68	106.40	104.2/ 3.0	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	P	1.50	R T	L-T	217.0	1.199	0.599	CT	0.625	0.35	81.10		1972	82543
		1.50			217.0	1.202	0.608	CT	0.645	0.17	56.80		1972	82543
		1.50			217.0	1.200	0.605	CT	0.619	0.12	47.40		1972	82543
		1.50			217.0	1.205	0.605	CT	0.641	0.30	73.10		1972	82543
		1.50			217.0	1.204	0.608	CT	0.648	0.21	62.60		1972	82543
		1.50			217.0	1.199	0.608	CT	0.612	0.14	50.40		1972	82543
		1.50			217.0	1.200	0.605	CT	0.630	0.41	87.90		1972	82543
		1.50			217.0	1.193	0.604	CT	0.610	0.12	46.80		1972	82543
		1.50			217.0	1.195	0.605	CT	0.621	0.26	69.40		1972	82543
		1.50			217.0	1.211	0.607	CT	0.632	0.14	50.40		1972	82543
		1.50			217.0	1.201	0.600	CT	0.599	0.23	66.30		1972	82543
		1.50			217.0	1.203	0.608	CT	0.623	0.12	47.70		1972	82543
		1.50			217.0	1.204	0.607	CT	0.628	0.25	68.20		1972	82543
		1.50			217.0	1.197	0.604	CT	0.644	0.28	72.20		1972	82543
		1.50			217.0	1.198	0.605	CT	0.636	0.18	57.80		1972	82543
		1.50			217.0	1.202	0.604	CT	0.641	0.31	76.50		1972	82543
		1.50			217.0	1.201	0.602	CT	0.618	0.32	77.90		1972	82543
		1.50			217.0	1.196	0.608	CT	0.642	0.09	40.20		1972	82543
		1.50			217.0	1.201	0.599	CT	0.618	0.12	48.00	62.2/ 14.0	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	F	1.50	-65	L-T	225.0	1.507	0.756	CT	0.773	0.05	31.80		1972	82543
		1.50			225.0	1.507	0.756	CT	0.773	0.05	31.80	31.8/ 0.0	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	F	1.50	20	L-T	222.0	1.506	0.755	CT	0.768	0.06	35.50		1972	82543
		1.50			222.0	1.506	0.755	CT	0.758	0.06	34.50		1972	82543
		1.50			222.0	1.504	0.753	CT	0.755	0.06	34.50	34.8/ 0.6	1972	82543
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	F	1.50	0	L-T	220.0	1.504	0.755	CT	0.791	0.06	34.60		1972	82543
1650F AUS-BAY QUENCH 975F,SQ 375F,1000F 2+2 HR	F	1.50	20	L-T	218.0	1.506	0.755	CT	0.782	0.08	39.00		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN/ STAN DEV	DATE	REFER
1650F AUS-BAY QUENCH 975F, SQ 375F,1000F 2+2 HR	F	1.50	20	L-T	218.0	1.503	0.751	CT	0.785	0.06	33.50		1972	82543
		1.50			218.0	1.506	0.756	CT	0.773	0.08	39.90	37.5/ 3.5	1972	82543
1650F AUS-BAY QUENCH 975F, SQ 375F,1000F 2+2 HR	F	1.50	RT	L-T	214.0	1.503	0.755	CT	0.794	0.11	44.70		1972	82543
		1.50			214.0	1.501	0.753	CT	0.771	0.13	48.40		1972	82543
		1.50			214.0	1.504	0.750	CT	0.783	0.10	42.40		1972	82543
		1.50			214.0	1.514	0.755	CT	0.764	0.12	46.10		1972	82543
		1.50			214.0	1.497	0.753	CT	0.762	0.16	54.40		1972	82543
		1.50			214.0	1.508	0.750	CT	0.766	0.11	45.10		1972	82543
		1.50			214.0	1.502	0.750	CT	0.768	0.12	46.80		1972	82543
		1.50			214.0	1.502	0.753	CT	0.767	0.09	40.30	46.0/ 4.2	1972	82543
1650F AUS-BAY QUENCH 975F, SQ 375F,1000F 2+2 HR	F	1.50	175	L-T	208.0	1.501	0.755	CT	0.780	0.19	57.30		1972	82543
		1.50			208.0	1.503	0.750	CT	0.775	0.33	75.60		1972	82543
		1.50			208.0	1.497	0.750	CT	0.773	0.20	59.40	64.1/10.0	1972	82543
1650F AUS-BAY QUENCH 975F, SQ 375F,1000F 2+2 HR	F	1.50	300	L-T	201.0	1.501	0.753	CT	0.762	0.51	90.50		1972	82543
		1.50			201.0	1.502	0.755	CT	0.779	0.54	93.40	92.0/ 2.1	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F,1000F 2+2 HR	P	0.80	65	L-T	228.0	1.501	0.755	CT	0.743	0.04	30.40		1972	82543
		0.80			228.0	1.503	0.751	CT	0.748	0.06	34.70		1972	82543
		0.80			228.0	1.504	0.755	CT	0.763	0.05	31.90		1972	82543
		0.80			228.0	1.504	0.758	CT	0.763	0.05	31.80		1972	82543
		0.80			228.0	1.507	0.759	CT	0.758	0.07	37.30	33.2/ 2.8	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F,1000F 2+2 HR	P	0.80	40	L-T	227.0	1.499	0.758	CT	0.770	0.06	36.70		1972	82543
		0.80			227.0	1.502	0.693	CT	0.750	0.07	37.00		1972	82543
		0.80			227.0	1.498	0.757	CT	0.758	0.07	37.60		1972	82543
		0.00			227.0	1.476	0.757	CT	0.760	0.07	30.50		1972	82543
		0.00			227.0	1.503	0.693	CT	0.765	0.07	37.30		1972	82543
		0.80			228.0	1.201	0.599	CT	0.624	0.08	41.20		1972	82543
		0.00			228.0	1.201	0.599	CT	0.608	0.08	41.40	38.5/ 2.0	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F,1000F 2+2 HR	P	0.80 - 20 HR		L-T	226.0	1.501	0.757	CT	0.748	0.08	39.10		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV STAN DEV	DATE	REFER
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	-20	L-T	226.0	1.498	0.757	CT	0.755	0.08	39.60		1972	82543
		0.80			226.0	1.501	0.755	CT	0.756	0.08	40.80		1972	82543
		0.80			226.0	1.501	0.757	CT	0.756	0.08	37.90		1972	82543
		0.80			226.0	1.502	0.757	CT	0.754	0.07	42.30	40.3/ 1.3	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	0	L-T	224.0	1.476	0.757	CT	0.781	0.09	42.40		1972	82543
		0.80			224.0	1.498	0.758	CT	0.772	0.10	44.50		1972	82543
		0.80			224.0	1.487	0.757	CT	0.746	0.08	40.20	42.4/ 2.2	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	20	L-T	222.0	1.500	0.757	CT	0.764	0.12	47.70		1972	82543
		0.80			222.0	1.502	0.758	CT	0.769	0.12	47.60		1972	82543
		0.80			222.0	1.503	0.758	CT	0.778	0.08	40.90	45.4/ 3.9	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	40	L-T	220.0	1.502	0.758	CT	0.770	0.15	54.30		1972	82543
		0.80			220.0	1.501	0.758	CT	0.773	0.14	51.30	52.8/ 2.1	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	R.T.	L-T	217.0	1.504	0.749	CT	0.767	0.39	86.10		1972	82543
		0.80			217.0	1.502	0.747	CT	0.771	0.42	89.40		1972	82543
		0.80			217.0	1.197	0.608	CT	0.622	0.16	54.20		1972	82543
		0.80			217.0	1.504	0.692	CT	0.752	0.16	56.00		1972	82543
		0.80			217.0	1.197	0.606	CT	0.622	0.28	56.10		1972	82543
		0.80			217.0	1.505	0.671	CT	0.755	0.15	53.90		1972	82543
		0.80			217.0	1.503	0.750	CT	0.768	0.14	52.00		1972	82543
		0.80			217.0	1.505	0.692	CT	0.765	0.18	59.00		1972	82543
		0.80			217.0	1.498	0.757	CT	0.756	0.24	66.60		1972	82543
		0.80			217.0	1.500	0.754	CT	0.762	0.36	81.70		1972	82543
		0.80			217.0	1.198	0.605	CT	0.623	0.20	61.90		1972	82543
		0.80			217.0	1.505	0.692	CT	0.747	0.18	57.70		1972	82543
		0.80			217.0	1.501	0.750	CT	0.756	0.16	54.00		1972	82543
		0.80			217.0	1.202	0.604	CT	0.633	0.35	80.80		1972	82543
		0.80			217.0	1.199	0.608	CT	0.617	0.34	79.60		1972	82543
		0.80			217.0	1.700	0.607	CT	0.624	0.35	81.50		1972	82543
		0.80			217.0	1.700	0.607	CT	0.622	0.28	73.30		1972	82543
		0.80			217.0	1.503	0.694	CT	0.770	0.16	55.70		1972	82543
		0.80			217.0	1.199	0.607	CT	0.624	0.36	81.90		1972	82543
		0.80			217.0	1.500	0.755	CT	0.762	0.24	66.70		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	$2.5 \ast (K(IC)/TYS)^{2}$ (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
1650F, AUS-BAY QUENCH 975F, 5Q 400F, 1000F 2+2 HR	P	0.80	R T	L-T	217.0	1.505	0.692	CT	0.762	0.19	60.20			1972	82543
		0.80			217.0	1.478	0.757	CT	0.771	0.29	73.60			1972	82543
		0.80			217.0	1.202	0.607	CT	0.621	0.21	63.40			1972	82543
		0.80			217.0	1.503	0.694	CT	0.753	0.20	61.80			1972	82543
		0.80			217.0	1.496	0.756	CT	0.747	0.45	92.30			1972	82543
		0.80			217.0	1.502	0.692	CT	0.779	0.20	61.90			1972	82543
		0.80			217.0	1.501	0.692	CT	0.755	0.10	43.90			1972	82543
		0.80			217.0	1.203	0.608	CT	0.625	0.29	73.40			1972	82543
		0.80			217.0	1.193	0.605	CT	0.613	0.17	57.50			1972	82543
		0.80			217.0	1.501	0.752	CT	0.765	0.11	46.40			1972	82543
		0.80			217.0	1.502	0.695	CT	0.762	0.10	44.50			1972	82543
		0.80			217.0	1.197	0.607	CT	0.625	0.42	88.80			1972	82543
		0.80			217.0	1.505	0.694	CT	0.755	0.19	59.40			1972	82543
		0.80			217.0	1.203	0.600	CT	0.635	0.18	58.90			1972	82543
		0.80			217.0	1.200	0.608	CT	0.616	0.18	58.60			1972	82543
		0.80			217.0	1.198	0.603	CT	0.636	0.17	56.00			1972	82543
		0.80			217.0	1.500	0.751	CT	0.729	0.32	77.10			1972	82543
		0.80			217.0	1.201	0.600	CT	0.622	0.17	59.50			1972	82543
		0.80			217.0	1.199	0.605	CT	0.621	0.44	91.00			1972	82543
		0.80			217.0	1.198	0.606	CT	0.619	0.18	58.00			1972	82543
		0.80			217.0	1.501	0.759	CT	0.756	0.18	48.50			1972	82543
		0.80			217.0	1.198	0.608	CT	0.622	0.14	52.10			1972	82543
		0.80			217.0	1.474	0.756	CT	0.755	0.18	58.60			1972	82543
		0.80			217.0	1.200	0.607	CT	0.620	0.31	76.80			1972	82543
		0.80			217.0	1.197	0.608	CT	0.617	0.31	76.60			1972	82543
		0.80			217.0	1.505	0.694	CT	0.758	0.21	62.90			1972	82543
		0.80			217.0	1.502	0.754	CT	0.766	0.37	83.60			1972	82543
		0.80			217.0	1.505	0.692	CT	0.759	0.16	55.40			1972	82543
		0.80			217.0	1.496	0.748	CT	0.744	0.20	60.80			1972	82543
		0.80			217.0	1.504	0.693	CT	0.776	0.17	57.20			1972	82543
		0.80			217.0	1.505	0.691	CT	0.747	0.18	59.00			1972	82543
		0.80			217.0	1.199	0.606	CT	0.613	0.33	79.30			1972	82543
		0.80			217.0	1.505	0.753	CT	0.765	0.14	50.60			1972	82543
		0.80			217.0	1.203	0.608	CT	0.619	0.42	88.90			1972	82543
		0.80			217.0	1.201	0.608	CT	0.615	0.19	60.70			1972	82543
		0.80			217.0	1.478	0.753	CT	0.781	0.13	50.00			1972	82543
		0.80			217.0	1.508	0.749	CT	0.779	0.19	59.50			1972	82543
		0.80			217.0	1.199	0.605	CT	0.630	0.33	78.40			1972	82543
		0.80			217.0	1.179	0.605	CT	0.630	0.18	57.80			1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV (KSI*SQRT IN)	DATE	REFER
1650F,AUS.BAY	F	0.80	R T	L-T	217.0	1.203	0.606	CT	0.621	0.24	52.80		1972	82543
QUENCH 975F,50		0.80			217.0	1.505	0.674	CT	0.753	0.20	60.90		1972	82543
HOUR,1000F		0.80			217.0	1.504	0.692	CT	0.741	0.16	54.50		1972	82543
2-2 HR		0.80			217.0	1.202	0.605	CT	0.630	0.32	78.00		1972	82543
		0.80			217.0	1.498	0.749	CT	0.766	0.27	71.40		1972	82543
		0.80			217.0	1.502	0.755	CT	0.751	0.16	54.00		1972	82543
		0.80			217.0	1.467	0.757	CT	0.749	0.18	57.90		1972	82543
		0.80			217.0	1.198	0.605	CT	0.630	0.31	76.20		1972	82543
		0.80			217.0	1.199	0.606	CT	0.617	0.14	50.60		1972	82543
		0.80			217.0	1.500	0.738	CT	0.777	0.32	77.70		1972	82543
		0.80			217.0	1.504	0.692	CT	0.774	0.16	55.20		1972	82543
		0.80			217.0	1.504	0.692	CT	0.764	0.17	57.00		1972	82543
		0.80			217.0	1.196	0.605	CT	0.620	0.22	64.20		1972	82543
		0.80			217.0	1.458	0.607	CT	0.838	0.23	66.00		1972	82543
		0.80			217.0	1.200	0.607	CT	0.625	0.30	75.40		1972	82543
		0.80			217.0	1.500	0.750	CT	0.764	0.15	52.80		1972	82543
		0.80			217.0	1.201	0.604	CT	0.641	0.18	58.00		1972	82543
		0.80			217.0	1.198	0.605	CT	0.624	0.20	61.80		1972	82543
		0.80			217.0	1.501	0.750	CT	0.766	0.12	48.60		1972	82543
		0.80			217.0	1.199	0.604	CT	0.612	0.40	86.90		1972	82543
		0.80			217.0	1.498	0.754	CT	0.768	0.23	65.40		1972	82543
		0.80			217.0	1.201	0.603	CT	0.640	0.24	66.70		1972	82543
		0.80			217.0	1.504	0.693	CT	0.765	0.15	53.30		1972	82543
		0.80			217.0	1.500	0.757	CT	0.787	0.16	54.60		1972	82543
		0.80			217.0	1.197	0.602	CT	0.617	0.19	60.30		1972	82543
		0.80			217.0	1.500	0.749	CT	0.768	0.37	83.50		1972	82543
		0.80			217.0	1.504	0.692	CT	0.762	0.15	53.50		1972	82543
		0.80			217.0	1.199	0.603	CT	0.625	0.18	59.00		1972	82543
		0.80			217.0	1.200	0.607	CT	0.618	0.31	76.40		1972	82543
		0.80			217.0	1.199	0.603	CT	0.629	0.15	52.40		1972	82543
		0.80			217.0	1.497	0.750	CT	0.774	0.19	60.00		1972	82543
		0.80			217.0	1.199	0.606	CT	0.638	0.31	76.60		1972	82543
		0.80			217.0	1.197	0.606	CT	0.638	0.12	47.70		1972	82543
		0.80			217.0	1.500	0.758	CT	0.784	0.26	70.50		1972	82543
		0.80			217.0	1.505	0.757	CT	0.770	0.19	59.20		1972	82543
		0.80			217.0	1.504	0.749	CT	0.769	0.28	72.70		1972	82543
		0.80			217.0	1.494	0.753	CT	0.773	0.16	54.70		1972	82543
		0.80			217.0	1.501	0.755	CT	0.746	0.16	55.60		1972	82543
		0.80			217.0	1.203	0.608	CT	0.621	0.27	71.60		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL

K_{IC}

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	TEST SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	0.80	RT	L-T	217.0	1.200	0.605	CT	0.621	0.21	62.30		1972	82543
		0.80			217.0	1.179	0.605	CT	0.630	0.20	60.80		1972	82543
		0.80			217.0	1.179	0.608	CT	0.635	0.20	61.60		1972	82543
		0.80			217.0	1.501	0.753	CT	0.773	0.13	50.30		1972	82543
					217.0	1.198	0.605	CT	0.625	0.42	89.00	64.4/ 12.1	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	0.80	120	L-T	211.0	1.499	0.757	CT	0.761	0.42	83.90		1972	82543
		0.80			211.0	1.500	0.757	CT	0.770	0.46	90.10	88.0/ 3.0	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	175	L-T	211.0	1.505	0.758	CT	0.775	0.47	91.90		1972	82543
		0.00			211.0	1.502	0.758	CT	0.784	0.44	88.60		1972	82543
		0.80			211.0	1.506	0.758	CT	0.779	0.44	88.10	89.5/ 2.1	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	P	0.80	300	L-T	204.0	1.505	0.759	CT	0.771	0.47	88.80		1972	82543
		0.80			204.0	1.501	0.759	CT	0.782	0.47	88.10		1972	82543
		0.80			204.0	1.501	0.750	CT	0.770	0.41	82.90	86.6/ 3.2	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	1.50	65	L-T	225.0	1.502	0.756	CT	0.784	0.06	34.00		1972	82543
		0.80			225.0	1.500	0.749	CT	0.760	0.06	35.70		1972	82543
		1.50			225.0	1.502	0.756	CT	0.790	0.04	29.00		1972	82543
		0.80			225.0	1.500	0.750	CT	0.757	0.06	33.60	33.1/ 2.9	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	0.80	40	L-T	224.0	1.495	0.694	CT	0.753	0.09	41.60		1972	82543
		0.80			224.0	1.477	0.693	CT	0.776	0.08	37.80	40.7/ 1.3	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	0.80	20	L-T	222.0	1.477	0.749	CT	0.769	0.08	41.10		1972	82543
		0.00			222.0	1.474	0.749	CT	0.765	0.07	38.10		1972	82543
		0.80			222.0	1.498	0.750	CT	0.759	0.10	44.40	41.2/ 3.2	1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	1.50	0	L-T	220.0	1.502	0.750	CT	0.769	0.07	36.50		1972	82543
1650F, AUS-BAY QUENCH 975F, SQ 400F, 1000F 2+2 HR	F	0.80	20	L-T	218.0	1.499	0.750	CT	0.757	0.10	44.60		1972	82543

6.4-18

TABLE 6.4.2.1 (Con't)

ALLOY STEEL

18NAC

K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	K(IC) STAN DEV	DATE	REFER
1450F, AUS-BAY QUENCH 975F,50 75F,1000F 2+2 HR	F	0.80	70	L-T	218.0	1.490	0.750	0.751	0.11	45.60			1972	82543
		0.80			218.0	1.499	0.750	0.761	0.11	40.00			1972	82543
											43.4 /	3.0		
1650F, AUS-BAY QUENCH 975F,50 400F,1000F 2+2 HR	F	0.80	RT	L-T	214.0	1.200	0.607	0.618	0.24	66.10			1972	82543
		0.80			214.0	1.200	0.607	0.625	0.34	78.60			1972	82543
		0.80			214.0	1.199	0.602	0.618	0.17	55.80			1972	82543
		0.80			214.0	1.199	0.607	0.623	0.29	73.10			1972	82543
		0.80			214.0	1.503	0.692	0.775	0.51	96.30			1972	82543
		0.80			214.0	1.178	0.693	0.628	0.14	50.30			1972	82543
		0.80			214.0	1.201	0.603	0.619	0.28	72.30			1972	82543
		0.80			214.0	1.202	0.602	0.618	0.16	55.10			1972	82543
		0.80			214.0	1.201	0.599	0.623	0.29	73.20			1972	82543
		0.80			214.0	1.498	0.757	0.754	0.20	60.60			1972	82543
		0.80			214.0	1.200	0.604	0.620	0.35	79.70			1972	82543
		0.80			214.0	1.499	0.750	0.762	0.18	57.90			1972	82543
		0.80			214.0	1.198	0.607	0.645	0.39	84.10			1972	82543
		0.80			214.0	1.202	0.603	0.631	0.26	68.70			1972	82543
		0.80			214.0	1.202	0.603	0.624	0.37	82.30			1972	82543
		0.80			214.0	1.200	0.607	0.634	0.34	79.50			1972	82543
		0.80			214.0	1.202	0.602	0.620	0.15	52.00			1972	82543
		0.80			214.0	1.199	0.602	0.621	0.30	73.60			1972	82543
		0.80			214.0	1.500	0.750	0.766	0.31	75.50			1972	82543
		0.80			214.0	1.498	0.696	0.747	0.18	57.40			1972	82543
		0.80			214.0	1.195	0.606	0.634	0.49	94.40			1972	82543
		0.80			214.0	1.203	0.604	0.627	0.22	64.20			1972	82543
		0.80			214.0	1.199	0.603	0.618	0.34	78.40			1972	82543
		0.80			214.0	1.497	0.749	0.755	0.20	59.80			1972	82543
		0.80			214.0	1.201	0.603	0.633	0.20	60.80			1972	82543
		0.80			214.0	1.199	0.603	0.617	0.34	78.40			1972	82543
		0.80			214.0	1.200	0.599	0.618	0.23	65.20			1972	82543
		0.80			214.0	1.200	0.605	0.626	0.20	60.40			1972	82543
		0.80			214.0	1.199	0.603	0.623	0.17	56.20			1972	82543
		0.80			214.0	1.200	0.604	0.622	0.27	70.00			1972	82543
		1.50			214.0	1.499	0.756	0.866	0.08	39.30			1972	82543
		0.80			214.0	1.201	0.603	0.615	0.15	53.10			1972	82543
		0.80			214.0	1.200	0.606	0.627	0.20	61.00			1972	82543
		0.80			214.0	1.497	0.752	0.760	0.24	66.50			1972	82543
		0.80			214.0	1.502	0.747	0.784	0.22	63.10			1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	STAN DEV	DATE	REFER
1650F.AUS-BAY QUENCH 975F,5Q 100F,100NF 2+2 HR	F	0.80	R.T.	L-T	214.0	1.198	0.608	CT	0.626	0.36	81.00			1972	82543
					214.0	1.479	0.750	CT	0.766	0.20	61.00			1972	82543
					214.0	1.502	0.692	CT	0.767	0.48	93.60			1972	82543
					214.0	1.200	0.603	CT	0.631	0.24	65.70			1972	82543
					214.0	1.200	0.607	CT	0.631	0.25	67.60			1972	82543
					214.0	1.497	0.694	CT	0.761	0.20	60.10			1972	82543
					214.0	1.197	0.607	CT	0.635	0.20	61.20			1972	82543
					214.0	1.501	0.750	CT	0.769	0.33	77.60			1972	82543
					214.0	1.497	0.753	CT	0.756	0.23	64.40			1972	82543
					214.0	1.202	0.603	CT	0.626	0.15	52.90			1972	82543
					214.0	1.198	0.608	CT	0.598	0.32	76.30			1972	82543
					214.0	1.200	0.605	CT	0.620	0.14	51.30			1972	82543
					214.0	1.199	0.608	CT	0.617	0.24	65.60			1972	82543
					214.0	1.201	0.603	CT	0.623	0.16	54.60			1972	82543
					214.0	1.502	0.750	CT	0.775	0.16	54.50			1972	82543
					214.0	1.200	0.605	CT	0.620	0.14	51.20			1972	82543
					214.0	1.502	0.750	CT	0.762	0.17	53.50			1972	82543
					214.0	1.497	0.750	CT	0.751	0.16	53.60	66.2/	12.3	1972	82543
1650F.AUS-BAY QUENCH 975F,5R 400F,1000F 2+2 HR	F	0.80	175	L-T	208.0	1.500	0.750	CT	0.762	0.37	80.30			1972	82543
					208.0	1.504	0.750	CT	0.771	0.34	77.10			1972	82543
					208.0	1.498	0.750	CT	0.757	0.32	74.30	77.2/	3.0	1972	82543
1650F.1 HR.FC TO 960F.DQ AT 180F.AC.1025F 2+2 HR	F	1.50	R.T.	--	219.0	1.000	0.500	CT	0.500	0.39	86.90			1972	84277
					219.0	1.000	0.500	CT	0.500	0.41	88.30			1972	84277
					219.0	1.000	0.500	CT	0.500	0.40	88.00	87.7/	0.7	1972	84277
1650F.1 HR.FC 1650F 1 HR.DQ, 1025F 2+2 HR	DT	7.00	R.T.	L-T	210.0	2.500	1.000	CT	1.400	0.38	81.80			1972	84277
					210.0	2.500	1.000	CT	1.400	0.32	75.10	78.5/	4.7	1972	84277
1650F.1 HR.FC TO 960F.DQ AT 150F.AC.1000F 2+2 HR	RT	7.00	R.T.	L-T	211.0	2.500	1.000	CT	1.400	0.36	79.70			1972	84277
					211.0	2.500	1.000	CT	1.400	0.37	80.90	80.3/	0.8	1972	84277

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D6AC K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH W (IN)	SPECIMEN THICK DESIGN B (IN)		CRACK LENGTH A (IN)	$2.5*(K(IC)/TYS)^{**2}$ (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	STAN DEV	DATE	REFER
1675F AC 1575F	P	1.00	R.T.	--	----	1.999	1.008	CT	1.105	0.42	78.30			1973	85883 (1)
UQ,400F 2 HR,		1.00			----	1.995	1.008	CT	1.076	0.40	76.20			1973	85883 (1)
1100F 2 HR		1.00			----	1.997	1.007	CT	1.075	0.42	77.60			1973	85883 (1)
(RC 42.5)		1.00			----	2.002	1.006	CT	1.069	0.40	76.50	77.2/	1.0	1973	85883 (1)
1675F AC,1575F	P	1.00	R.T.	--	----	1.996	1.006	CT	1.118	0.15	53.10			1973	85883 (2)
UQ,400F 2 HR,		1.00			----	1.995	1.006	CT	1.139	0.15	53.50			1973	85883 (2)
800F 2 HR		1.00			----	1.995	1.006	CT	1.116	0.16	55.90			1973	85883 (2)
(RC 46.5)		1.00			----	1.992	1.006	CT	1.097	0.14	52.20	53.7/	1.6	1973	85883 (2)
1675F,AC,1575F	P	1.00	R.T.	--	----	1.996	1.007	CT	1.059	0.05	35.80			1973	85883 (3)
UQ,400F 2 HR,		1.00			----	2.001	1.007	CT	1.031	0.05	34.00			1973	85883 (3)
500F 2 HR		1.00			----	1.999	1.007	CT	1.046	0.04	33.00			1973	85883 (3)
(RC 50)		1.00			----	1.996	1.007	CT	1.032	0.05	35.10	34.5/	1.2	1973	85883 (3)
1700F,AUS-BAY	P	0.80	-65	L-T	228.0	1.502	0.759	CT	0.774	0.13	51.40			1972	82543
QUENCH 975F,UQ		0.80			228.0	1.499	0.749	CT	0.755	0.16	58.50			1972	82543
145F,1000F		0.80			228.0	1.502	0.749	CT	0.748	0.13	52.80			1972	82543
2*2 HR		1.50			228.0	1.502	0.755	CT	0.763	0.11	48.70			1972	82543
		1.50			228.0	1.502	0.750	CT	0.759	0.10	46.40			1972	82543
		0.80			228.0	1.501	0.750	CT	0.780	0.17	59.80			1972	82543
		1.50			228.0	1.502	0.750	CT	0.753	0.09	42.20			1972	82543
		1.50			228.0	1.502	0.750	CT	0.759	0.10	46.40			1972	82543
		0.80			228.0	1.506	0.759	CT	0.774	0.15	56.40	51.4/	6.0	1972	82543
1700F,AUS-BAY	P	1.50	-40	L-T	227.0	1.501	0.750	CT	0.768	0.09	43.70			1972	82543
QUENCH 975F,UQ		1.50			227.0	1.499	0.754	CT	0.772	0.11	47.90			1972	82543
145F,1000F		1.50			227.0	1.503	0.749	CT	0.768	0.10	44.60	45.4/	2.2	1972	82543
2*2 HR															
1700F,AUS-BAY	F	1.50	-20	L-T	226.0	1.502	0.752	CT	0.779	0.14	54.00			1972	82543
QUENCH 975F,UQ		0.80			226.0	1.500	0.753	CT	0.759	0.28	73.20			1972	82543
145F,1000F 2*2 HR															

NOTES:
(1) TYS APPROX 170
(2) TYS APPROX 220
(3) TYS APPROX 250

6.4-21

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   DGAC   K(IC)

CONDITION	FORM	PRODUCT THICK (IN)	TEST TEMP (F)	TEST SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH W (IN)	SPECIMEN THICK B (IN)	DESIGN	CRACK LENGTH A (IN)	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN / STAN DEV	DATE	REFER
1700F,AUS-BAY QUENCH 975F.OQ 140F,1000F 2+2 HR	F	0.80	20	L-T	226.0	1.504	0.749	CT	0.756	0.24	67.30		1972	82543
		0.80			226.0	1.504	0.754	CT	0.773	0.27	74.00		1972	82543
		1.50			226.0	1.501	0.750	CT	0.763	0.12	50.40		1972	82543
		0.80			226.0	1.506	0.749	CT	0.756	0.27	74.40		1972	82543
		1.70			226.0	1.501	0.750	CT	0.763	0.12	50.40		1972	82543
		0.80			226.0	1.502	0.755	CT	0.760	0.23	67.90		1972	82543
		1.50			226.0	1.499	0.749	CT	0.754	0.10	45.90	62.4/ 12.0	1972	82543
1700F,AUS-BAY QUENCH 975F.OQ 140F,1000F 2+2 HR	P	1.50	0	L-T	224.0	1.502	0.750	CT	0.768	0.14	53.60		1972	82543
		1.50			224.0	1.479	0.755	CT	0.799	0.16	56.50		1972	82543
		1.50			225.0	1.503	0.750	CT	0.767	0.15	54.80	55.0/ 1.5	1972	82543
1700F,AUS-BAY QUENCH 975F.OQ 140F,1000F 2+2 HR	P	1.50	20	L-T	222.0	1.500	0.755	CT	0.788	0.17	59.10		1972	82543
		1.50			222.0	1.501	0.750	CT	0.778	0.17	58.40		1972	82543
		0.80			222.0	1.502	0.754	CT	0.770	0.41	89.90		1972	82543
		0.00			222.0	1.504	0.755	CT	0.770	0.35	83.70		1972	82543
		0.80			222.0	1.501	0.753	CT	0.753	0.37	85.70		1972	82543
		1.50			222.0	1.500	0.748	CT	0.762	0.26	71.30		1972	82543
		0.80			222.0	1.504	0.754	CT	0.765	0.37	87.20	76.5/ 13.5	1972	82543
1700F,AUS-BAY QUENCH 975F.OQ 140F,1000F 2+2 HR	P	1.50	40	L-T	220.0	1.501	0.750	CT	0.790	0.22	66.10		1972	82543
		1.50			220.0	1.501	0.749	CT	0.767	0.33	80.50		1972	82543
		1.50			220.0	1.499	0.752	CT	0.779	0.21	64.50	70.4/ 8.8	1972	82543
1700F,AUS-BAY QUENCH 975F.OQ 140F,1000F 2+2 HR	P	0.00	RT	L-T	217.0	1.479	0.747	CT	0.761	0.55	101.70		1972	82543
		0.80			217.0	1.506	0.752	CT	0.759	0.44	90.60		1972	82543
		0.80			217.0	1.478	0.756	CT	0.773	0.50	97.20		1972	82543
		0.80			217.0	1.500	0.749	CT	0.755	0.48	95.10		1972	82543
		0.80			217.0	1.502	0.757	CT	0.779	0.47	94.20		1972	82543
		0.80			217.0	1.504	0.757	CT	0.790	0.50	97.00		1972	82543
		0.80			217.0	1.202	0.607	CT	0.624	0.46	92.80		1972	82543
		1.50			217.0	1.497	0.757	CT	0.781	0.32	77.40		1972	82543
		1.50			217.0	1.477	0.758	CT	0.782	0.27	70.80		1972	82543
		0.80			217.0	1.503	0.758	CT	0.766	0.45	92.50		1972	82543
		0.80			217.0	1.504	0.750	CT	0.791	0.49	96.30		1972	82543
		0.80			217.0	1.502	0.756	CT	0.786	0.37	83.30		1972	82543
		0.80			217.0	1.501	0.757	CT	0.759	0.52	99.10		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN/STAN DEV (KSI SQRT IN)	DATE	REFER
1700F,AUS BAY QUENCH 975F,OR 140F,1000F 2+2 HR	P	0.80	R T	L-T	217.0	1.501	0.757	CT	0.773	0.48	95.40		1972	82543
		1.50			217.0	1.503	0.750	CT	0.779	0.45	91.70		1972	82543
		0.80			217.0	1.495	0.752	CT	0.767	0.44	91.00		1972	82543
		0.80			217.0	1.498	0.692	CT	0.747	0.47	93.90		1972	82543
		0.80			217.0	1.537	0.752	CT	0.817	0.47	96.50		1972	82543
		0.80			217.0	1.201	0.607	CT	0.621	0.44	91.40		1972	82543
		0.80			217.0	1.498	0.674	CT	0.759	0.47	96.10		1972	82543
		1.50			217.0	1.477	0.758	CT	0.769	0.45	92.60		1972	82543
		0.80			217.0	1.503	0.756	CT	0.755	0.49	96.30		1972	82543
		0.80			217.0	1.500	0.753	CT	0.754	0.46	93.20		1972	82543
		0.80			217.0	1.502	0.749	CT	0.759	0.45	91.90		1972	82543
		0.80			217.0	1.495	0.757	CT	0.802	0.47	94.20		1972	82543
		0.80			217.0	1.500	0.750	CT	0.792	0.44	91.20		1972	82543
		0.80			217.0	1.500	0.751	CT	0.756	0.51	98.20		1972	82543
		1.50			217.0	1.504	0.750	CT	0.765	0.22	64.10		1972	82543
		0.80			217.0	1.496	0.757	CT	0.803	0.53	100.50		1972	82543
		0.80			217.0	1.497	0.758	CT	0.776	0.48	94.70	92.0/ 8.2	1972	82543
1700F,AUS-BAY QUENCH 975F,OR 140F,1000F 2+2 HR	P	1.50	175	L-T	211.0	1.501	0.750	CT	0.763	0.51	93.20		1972	82543
		1.50			211.0	1.500	0.749	CT	0.760	0.44	89.20		1972	82543
		0.80			211.0	1.499	0.752	CT	0.752	0.45	89.30		1972	82543
		1.50			211.0	1.501	0.752	CT	0.785	0.48	92.70		1972	82543
		0.80			211.0	1.501	0.754	CT	0.779	0.52	96.50		1972	82543
		0.80			211.0	1.506	0.753	CT	0.761	0.46	90.70	92.3/ 3.1	1972	82543
1700F,AUS-BAY QUENCH 975F,OR 140F,1000F 2+2 HR	P	1.50	300	L-T	204.0	1.477	0.750	CT	0.779	0.45	86.40		1972	82543
		1.50			204.0	1.499	0.754	CT	0.790	0.50	91.30		1972	82543
		1.50			204.0	1.477	0.749	CT	0.758	0.47	80.00	88.6/ 2.5	1972	82543
1700F,AUS-BAY QUENCH 975F,OR 140F,1000F 2+2 HR	F	1.50	-65	L-T	225.0	1.501	0.749	CT	0.762	0.14	52.80		1972	82543
		1.50			225.0	1.500	0.753	CT	0.758	0.08	41.10		1972	82543
		1.50			225.0	1.500	0.751	CT	0.789	0.11	47.50		1972	82543
		1.50			225.0	1.501	0.752	CT	0.760	0.09	42.60		1972	82543
		1.50			225.0	1.501	0.752	CT	0.760	0.07	41.90		1972	82543
		1.50			225.0	1.502	0.751	CT	0.783	0.11	47.30	45.5/ 4.5	1972	82543
1700F,AUS BAY QUENCH 975F,OR 140F,1000F 2+2 HR	F	1.50	-20	L-T	222.0	1.501	0.750	CT	0.752	0.16	55.70		1972	82543

TABLE 6.4.2.1 (Con't)

ALLOY STEEL D(AC) K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV STAN	DATE	REFER
1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR	F	1.50	20	L-T	222.0	1.501	0.750	CT	0.777	0.25	69.60		1972	82543
		1.50			222.0	1.498	0.751	CT	0.765	0.12	49.60	58.3/ 10.3	1972	82543
1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR	F	1.50	20	L-T	218.0	1.499	0.750	CT	0.741	0.19	60.00		1972	82543
		1.50			218.0	1.500	0.750	CT	0.778	0.31	76.50		1972	82543
		1.50			218.0	1.500	0.752	CT	0.770	0.21	63.10	66.5/ 8.8	1972	82543
1700F, AUS-BAY QUENCH 975F, OQ 140F, 1000F 2+2 HR	F	0.80	R.T.	L-T	214.0	1.501	0.750	CT	0.759	0.46	91.80		1972	82543
		0.80			214.0	1.499	0.757	CT	0.760	0.49	95.30		1972	82543
		0.80			214.0	1.501	0.748	CT	0.755	0.57	102.40		1972	82543
		0.80			214.0	1.494	0.757	CT	0.758	0.47	93.00		1972	82543
		0.80			214.0	1.500	0.750	CT	0.771	0.57	102.00		1972	82543
		0.80			214.0	1.497	0.748	CT	0.774	0.65	107.40		1972	82543
		0.80			214.0	1.500	0.752	CT	0.769	0.56	101.70		1972	82543
		0.80			214.0	1.493	0.748	CT	0.758	0.60	105.30		1972	82543
		0.80			214.0	1.500	0.751	CT	0.781	0.57	102.20		1972	82543
		0.80			214.0	1.497	0.750	CT	0.755	0.53	98.60		1972	82543
		0.80			214.0	1.499	0.750	CT	0.753	0.47	92.80		1972	82543
		0.80			214.0	1.500	0.748	CT	0.757	0.56	100.90		1972	82543
		1.50			214.0	1.504	0.751	CT	0.770	0.39	84.90		1972	82543
		1.50			214.0	1.503	0.751	CT	0.771	0.36	81.70		1972	82543
		1.50			214.0	1.501	0.752	CT	0.765	0.39	84.90		1972	82543
		1.50			214.0	1.498	0.750	CT	0.762	0.53	98.50		1972	82543
		0.80			214.0	1.478	0.749	CT	0.759	0.45	91.00		1972	82543
		0.80			214.0	1.503	0.750	CT	0.778	0.45	90.40		1972	82543
		0.80			214.0	1.498	0.757	CT	0.767	0.53	98.50		1972	82543
		0.80			214.0	1.497	0.750	CT	0.762	0.47	93.00		1972	82543
		1.50			214.0	1.503	0.753	CT	0.759	0.46	92.00		1972	82543
		0.80			214.0	1.500	0.751	CT	0.814	0.50	95.80		1972	82543
		0.80			214.0	1.499	0.750	CT	0.753	0.47	92.80		1972	82543
		1.50			214.0	1.501	0.751	CT	0.757	0.48	93.60		1972	82543
		0.80			214.0	1.500	0.749	CT	0.759	0.46	91.60		1972	82543
		1.50			214.0	1.501	0.752	CT	0.774	0.44	89.70		1972	82543
		1.50			214.0	1.501	0.749	CT	0.789	0.47	92.60		1972	82543
		1.50			214.0	1.500	0.752	CT	0.763	0.46	91.50		1972	82543
		1.50			214.0	1.497	0.756	CT	0.762	0.47	94.30		1972	82543
		0.80			214.0	1.500	0.750	CT	0.768	0.39	84.80		1972	82543

6.4-24

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	STAN DEV	DATE	REFER
1700F, AUS BAY	F	0.80	R.T.	L-T	214.0	1.504	0.748	CT	0.743	0.58	102.90			1972	82543
QUENCH 975F, OQ		0.80			214.0	1.501	0.747	CT	0.779	0.52	97.60			1972	82543
1ACF, 1000F		0.80			214.0	1.501	0.750	CT	0.758	0.51	96.50			1972	82543
2+2 HR		0.80			214.0	1.500	0.756	CT	0.782	0.58	103.10	95.2/	6.4	1972	82543
1700F, AUS-BAY	F	1.50	175	L-T	208.0	1.501	0.756	CT	0.778	0.57	99.50			1972	82543
QUENCH 975F, OQ		1.50			208.0	1.501	0.756	CT	0.774	0.54	96.30			1972	82543
150F, 1000F		1.50			208.0	1.500	0.755	CT	0.762	0.54	96.70	97.5/	1.7	1972	82543
2+2 HR															
1700F, 1 HR, FC	BT	7.00	R.T.	L-T	215.0	2.500	1.000	CT	1.400	0.31	75.70			1972	84277
TO 960F, 0Q AT		7.00			215.0	2.500	1.000	CT	1.400	0.38	84.30			1972	84277
150F, AC, 1000F		7.00			215.0	2.500	1.000	CT	1.400	0.35	80.80	80.3/	4.3	1972	84277
2+2 HR															
1700F, 1 HR, 0Q,	BT	7.00	R.T.	L-T	214.0	2.500	1.000	CT	1.400	0.33	78.40			1972	84277
1025F 2+2 HR		7.00			214.0	2.500	1.000	CT	1.400	0.36	81.10			1972	84277
		7.00			214.0	2.500	1.000	CT	1.400	0.33	78.10			1972	84277
		10.00			216.0	2.500	1.000	CT	1.400	0.30	75.30			1972	84277
		10.00			216.0	2.500	1.000	CT	1.400	0.32	77.10			1972	84277
		10.00			216.0	2.500	1.000	CT	1.400	0.29	73.70	77.3/	2.6	1972	84277
1725F, 1 HR, AC	BT	7.00	R.T.	L-T	213.0	2.500	1.000	CT	1.400	0.35	80.10			1972	84277
1700F 1 HR, 0Q,		7.00			213.0	2.500	1.000	CT	1.400	0.33	76.90			1972	84277
1000F 1 HR.		7.00			213.0	2.500	1.000	CT	1.400	0.31	74.70	77.2/	2.7	1972	84277
1015F 1 HR															
1725F, 1 HR, AC	BT	7.00	R.T.	L-T	200.0	2.500	1.000	CT	1.400	0.52	91.20			1972	84277
1700F 1 HR, 0Q,		7.00			200.0	2.500	1.000	CT	1.400	0.60	97.70			1972	84277
1100F 2+2 HR		7.00			200.0	2.500	1.000	CT	1.400	0.74	109.00			1972	84277
		10.00			205.0	2.500	1.000	CT	1.400	0.63	103.00			1972	84277

6.4-25

TABLE 6.4.2.1 (Con't)

ALLOY STEEL   D6AC   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)² (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1725F,1 HR,AC	BT	10.00	R T	L-T	205.0	2.500	1.000	CT	1.400	0.62	102.00		1972	84277
1700F 1 HR,OQ,		10.00			205.0	2.500	1.000	CT	1.400	0.65	104.00		1972	84277
1100F 2+2 HR												101.2/ 6.1		
1725F,1 HR,AC	BT	7.00	R T.	L-T	213.0	2.500	1.000	CT	1.400	0.38	83.10		1972	84277
1700F 1 HR,OQ,		7.00			213.0	2.500	1.000	CT	1.400	0.31	75.90		1972	84277
1025F 2+2 HR		7.00			213.0	2.500	1.000	CT	1.400	0.30	73.20		1972	84277
		10.00			217.0	2.500	1.000	CT	1.400	0.22	64.60		1972	84277
		10.00			217.0	2.500	1.000	CT	1.400	0.32	77.90		1972	84277
		10.00			217.0	2.500	1.000	CT	1.400	0.27	71.90	74.4/ 6.2	1972	84277
1725F 1 HR,AC	BT	7.00	R T	L-T	221.0	2.500	1.000	CT	1.400	0.32	78.80		1972	84277
1650F 1 HR,FC		7.00			221.0	2.500	1.000	CT	1.400	0.21	63.70		1972	84277
TO 960F,SQ		7.00			221.0	2.500	1.000	CT	1.400	0.35	82.80	75.1/ 10.1	1972	84277
350F 0 3 HR,AC,1025F 2+2 HR														

TABLE 6.4.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 375F, 1000F
2+2HR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. JP-4 FUEL 3HZ	E= R.T. DIST H2O 1HZ		
DELTA K MIN	A:	10.07	.963			
	B:	9.70		.930		
	C:					
	D:					
		10.00		.932		
		13.00	1.83	2.25		
		16.00		4.27		
		20.00		7.55		
		25.00		12.2		
		30.00		17.4		
DELTA K MAX	A:	14.40	3.49			
	B:	30.90		18.3		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			17.19	14.86		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			
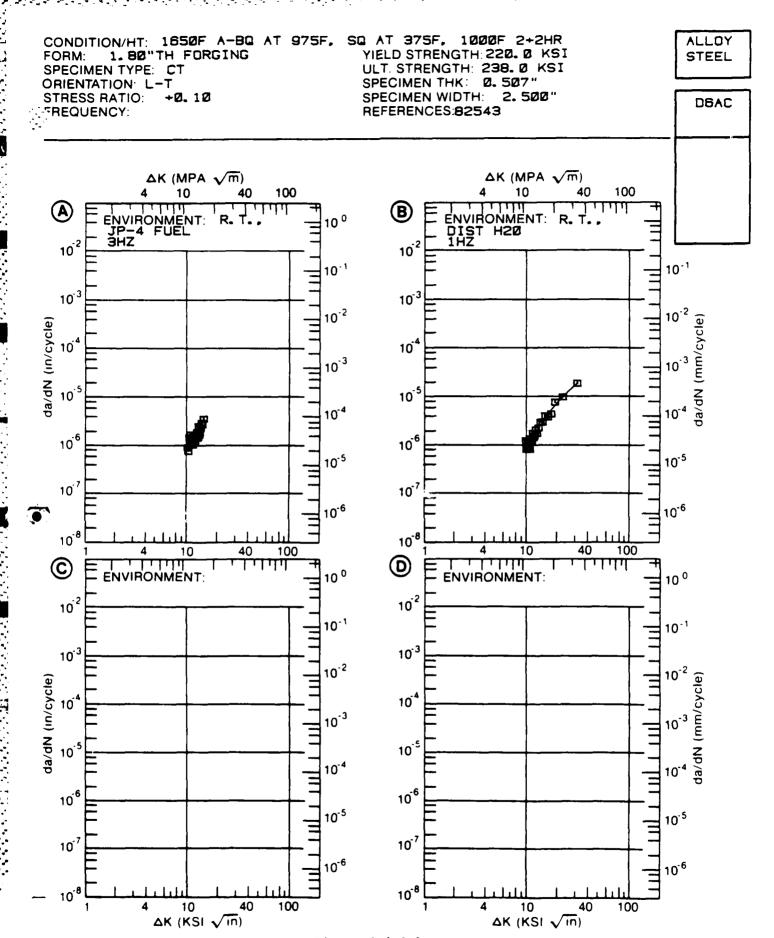
CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.507"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.1

TABLE 6.4.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BG AT 975F, SQ AT 375F, 1000F
           2+2HR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R. T. JP-4 FUEL			
DELTA K MIN	A:	8.99	.241			
	B:					
	C:					
	D:					
		9.00	.243			
		10.00	.471			
		13.00	1.81			
		16.00	3.85			
		20.00	6.36			
DELTA K MAX	A:	24.55	7.62			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	17.15

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING   YIELD STRENGTH:220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.507"
STRESS RATIO: +0.10   SPECIMEN WIDTH: 2.500"
FREQUENCY: 1.00 HZ   REFERENCES:82543

ALLOY
STEEL

D6AC

Figure 6.4.3.2

6.4-31

TABLE 6.4.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
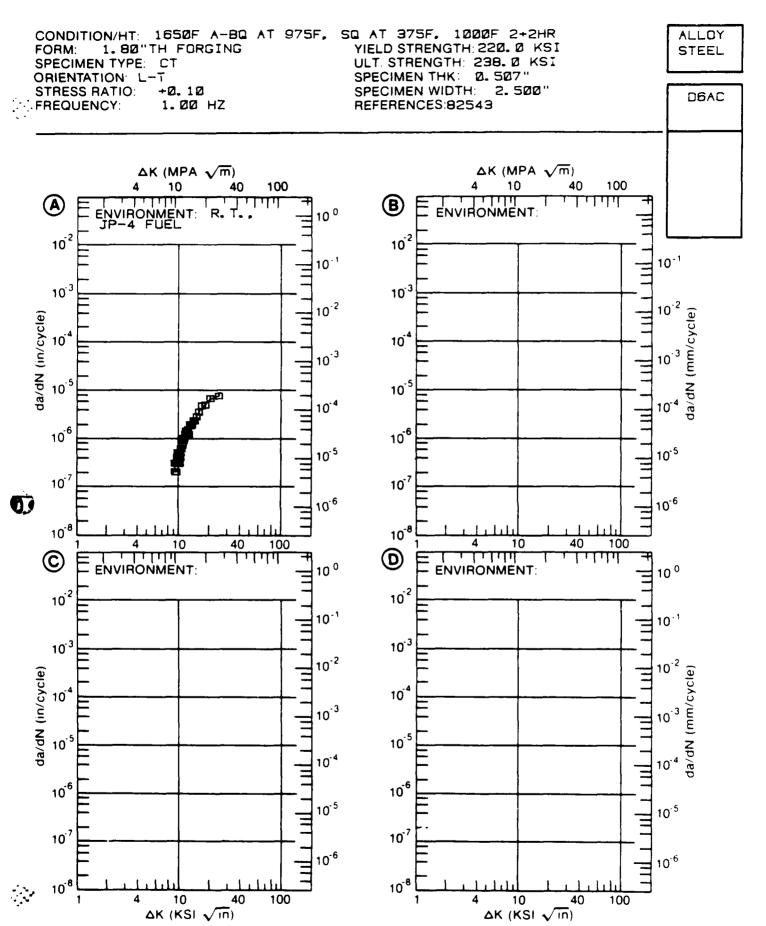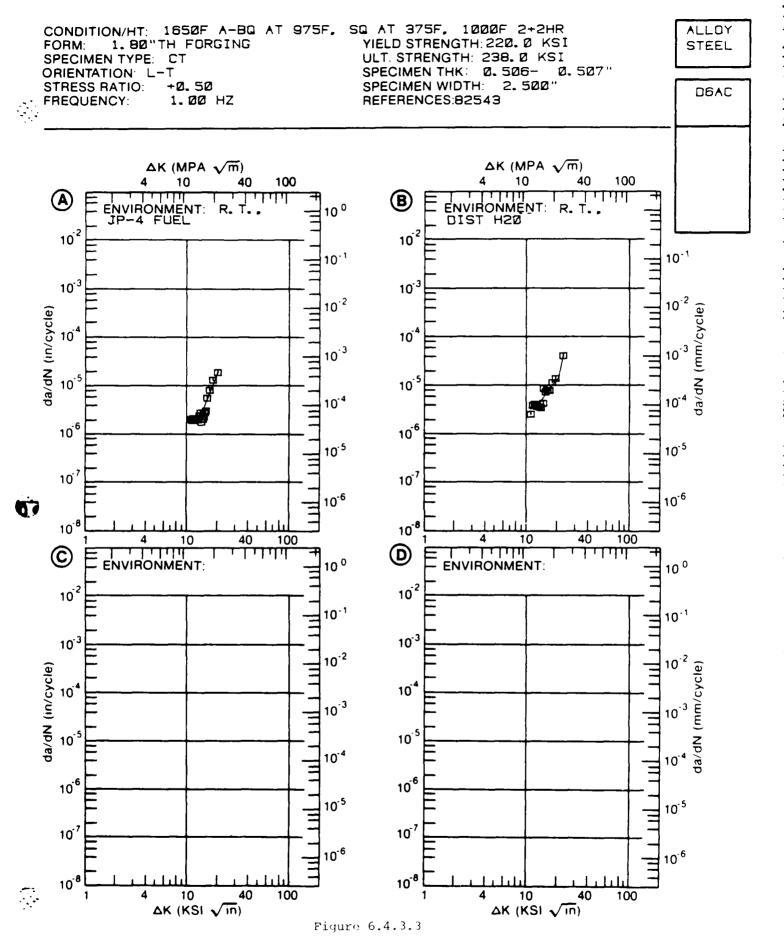
DATA ASSOCIATED WITH FIGURE 6.4.3.3 INDICATING EFFECT
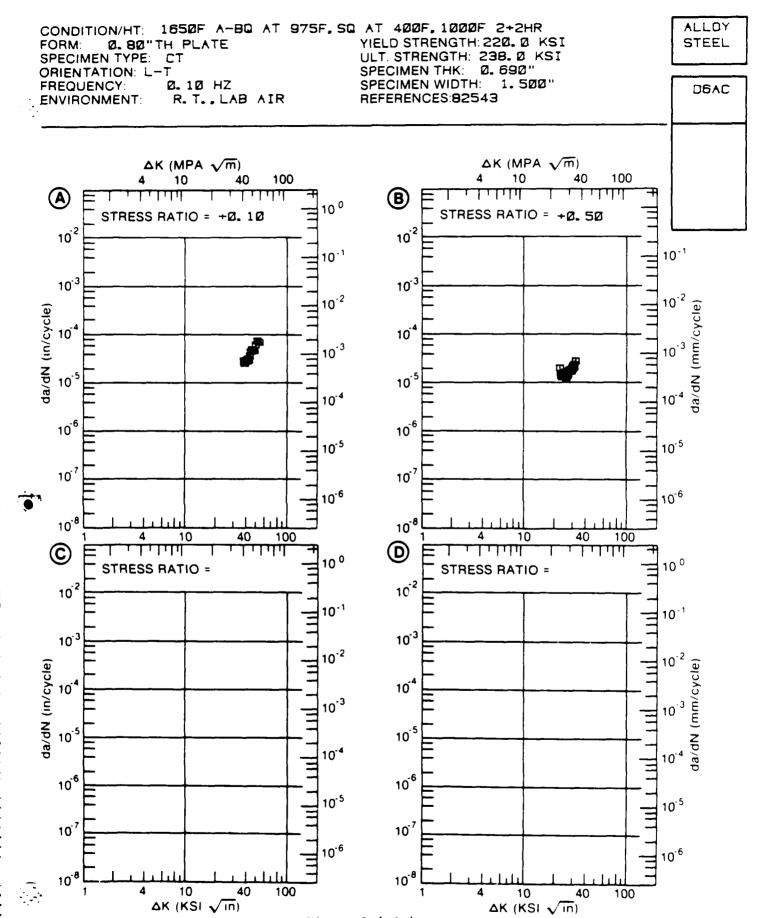
OF ENVIRONMENT

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 375F, 1000F
           2+2HR

DELTA K (KSI*IN**1/2)		:	DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	E= R.T. JP-4 FUEL	E= R.T. DIST H2O		
DELTA K MIN	A: 10.86	:	1.84			
	B: 10.78	:		3.22		
	C:	:				
	D:	:				
	13.00	:	2.05	3.99		
	16.00	:	5.70	7.97		
	20.00	:		13.9		
DELTA K MAX	A: 19.86	:	18.8			
	B: 22.37	:		40.5		
	C:	:				
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	23.17	18.87		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 375F, 1000F 2+2HR
FORM: 1.80"TH FORGING   YIELD STRENGTH:220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.506- 0.507"
STRESS RATIO: +0.50   SPECIMEN WIDTH: 2.500"
FREQUENCY: 1.00 HZ   REFERENCES:82543

ALLOY
STEEL

D6AC

Figure 6.4.3.3

6.4-33

TABLE 6.4.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.4 INDICATING EFFECT
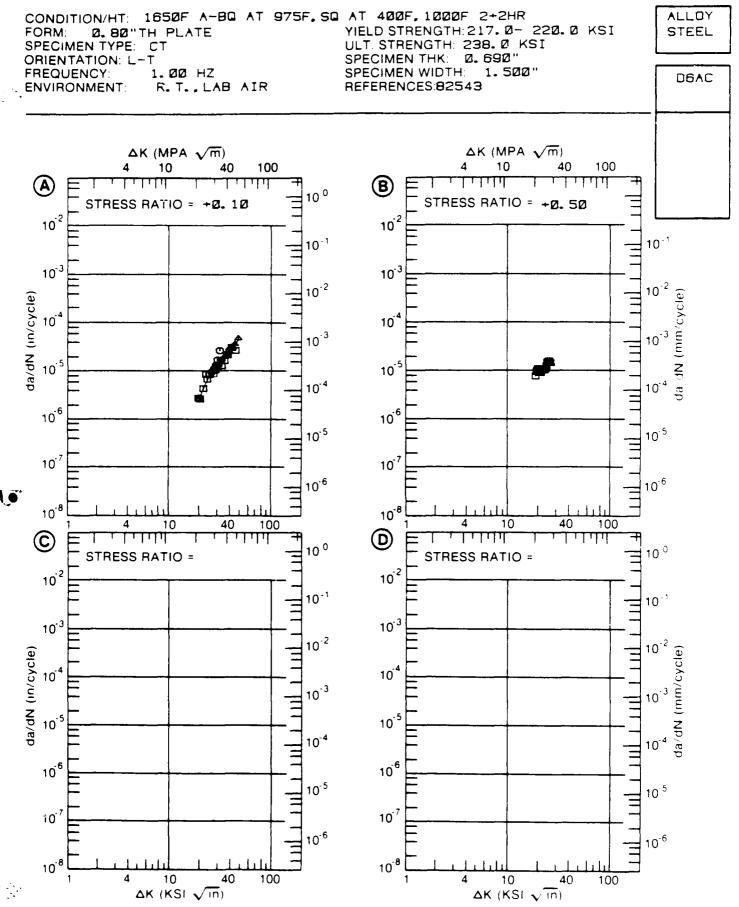
OF STRESS RATIO

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
           2+2HR
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10	R=+0.50		
DELTA K MIN	A:	37.20	25.7			
	B:	22.01		14.0		
	C:					
	D:					
		25.00		14.0		
		30.00		21.7		
		35.00				
		40.00	28.5			
		50.00	65.2			
DELTA K MAX	A:	52.74	71.2			
	B:	31.32		25.5		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			8.34	9.73		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5					
	0.5-0.8					
	0.8-1.25		1	1		
	1.25-2.0					
	>2.0					

CONDITION/HT: 1650F A-BQ AT 975F. SQ AT 400F. 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.690"
FREQUENCY: 0.10 HZ   SPECIMEN WIDTH: 1.500"
ENVIRONMENT: R.T., LAB AIR REFERENCES: 82543

Figure 6.4.3.4

TABLE 6.4.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
           2+2HR
ENVIRONMENT: R.T. , LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
DELTA K MIN	A: 19.32	2.28			
	B: 18.50		9.46		
	C:				
	D:				
	20.00	2.85	9.29		
	25.00	8.21	14.2		
	30.00	13.8			
	35.00	19.1			
	40.00	25.5			
DELTA K MAX	A: 47.75	42.0			
	B: 26.21		16.8		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		17.60	11.10		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	1	1		
	0.5-0.8	1			
	0.8-1.25	1			
	1.25-2.0				
	>2.0				

CONDITION/HT: 1650F A-BQ AT 975F. SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH:217. 0- 220. 0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238. 0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0. 690"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 1.500"
ENVIRONMENT: R. T.. LAB AIR   REFERENCES:82543

ALLOY
STEEL

D6AC

TABLE 6.4.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.6 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
           2+2HR
ENVIRONMENT: R.T. ,DIST H2O

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	F(HZ)= 0.10	F(HZ)= 1.00		
	:				
A:	:				
DELTA K B:	:				
MIN C:	:				
D:	:				
200.00	:				
A:	:				
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE	0.00	0.00
PERCENT ERROR		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1650F A-BQ AT 975F. SQ AT 400F. 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R.T.,DIST H2O

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.750"
SPECIMEN WIDTH: 5.000"
REFERENCES.82543

ALLOY STEEL

D6AC

A — FREQUENCY (Hz) = 0.10

B — FREQUENCY (Hz) = 1.00

C — FREQUENCY (Hz) =

D — FREQUENCY (Hz) =

TABLE 6.4.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.7 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
              2+2HR
ENVIRONMENT: R.T. ,DRY AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
DELTA K A: 13.47	:	1.39			
MIN B: 13.43	:		1.07		
C: 13.52	:			1.11	
D:	:				
16.00	:	2.79	2.45	2.59	
20.00	:	5.58	5.24	5.43	
25.00	:	9.39	8.84	8.61	
30.00	:	13.3	12.2	11.5	
35.00	:	17.5	15.6		
DELTA K A: 36.15	:	18.6			
MAX B: 35.22	:		15.7		
C: 34.37	:			14.4	
D:	:				
ROOT MEAN SQUARE PERCENT ERROR		7.09	8.90	6.09	

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				
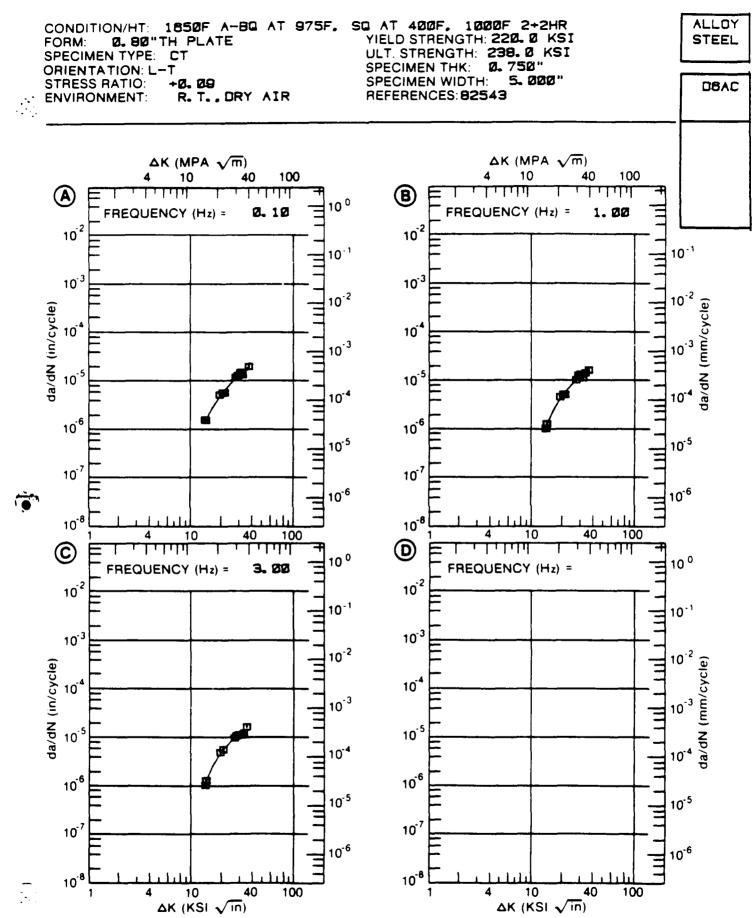
CONDITION/HT: 1650F A-BQ AT 975F. SQ AT 400F. 1000F 2+2HR

FORM: 0.80"TH PLATE YIELD STRENGTH: 220.0 KSI

SPECIMEN TYPE: CT ULT. STRENGTH: 238.0 KSI

ORIENTATION: L-T SPECIMEN THK: 0.750"

STRESS RATIO: +0.09 SPECIMEN WIDTH: 5.000"

ENVIRONMENT: R.T., DRY AIR REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.7

6.4-41

TABLE 6.4.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.8 INDICATING EFFECT OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
            2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
	A:	10.28	2.31			
DELTA K B:		10.19		1.01		
MIN C:		9.80			.639	
	D:					
		10.00			.736	
		13.00	3.32	2.86	2.64	
		16.00	5.48	5.05	4.21	
		20.00	10.4	7.44	5.31	
		25.00	20.2	9.60	6.64	
		30.00	33.1	11.5	9.58	
		35.00	46.7	13.7		
		40.00	58.2			
	A:	49.58	67.9			
DELTA K B:		36.95		14.8		
MAX C:		34.21			15.1	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			21.60	13.73	15.78	

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.751"
STRESS RATIO: +0.10   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., JP-4 FUEL   REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.8

6.4-43

TABLE 6.4.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
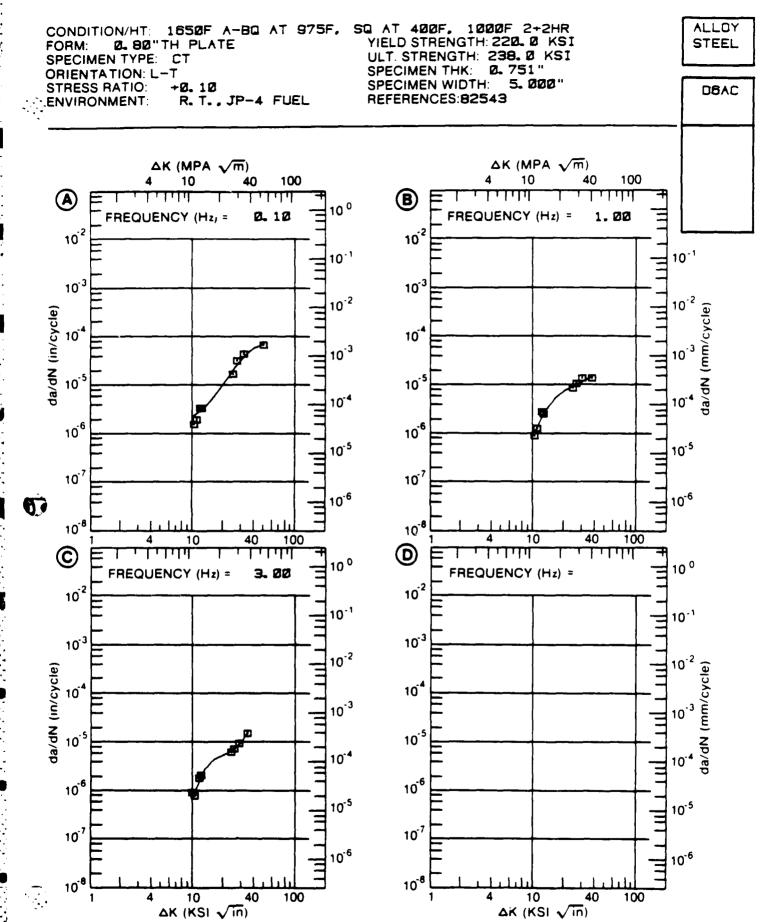
DATA ASSOCIATED WITH FIGURE 6.4.3.9 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
           2+2HR
ENVIRONMENT: R.T. ,JP-4 FUEL

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
	A:					
DELTA K	B:	9.99		2.13		
MIN	C:	9.80			.980	
	D:					
		10.00		2.14	1.09	
		13.00		4.58	2.83	
		16.00		6.39	4.38	
		20.00		9.06	6.45	
		25.00		16.4	11.0	
	A:					
DELTA K	B:	29.90		37.2		
MAX	C:	27.00			14.2	
	D:					

		A	B	C	
ROOT MEAN SQUARE PERCENT ERROR		0.00	8.91	12.64	

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1850F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
ENVIRONMENT: R.T., JP-4 FUEL

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.758"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.9

6.4-45

TABLE 6.4.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
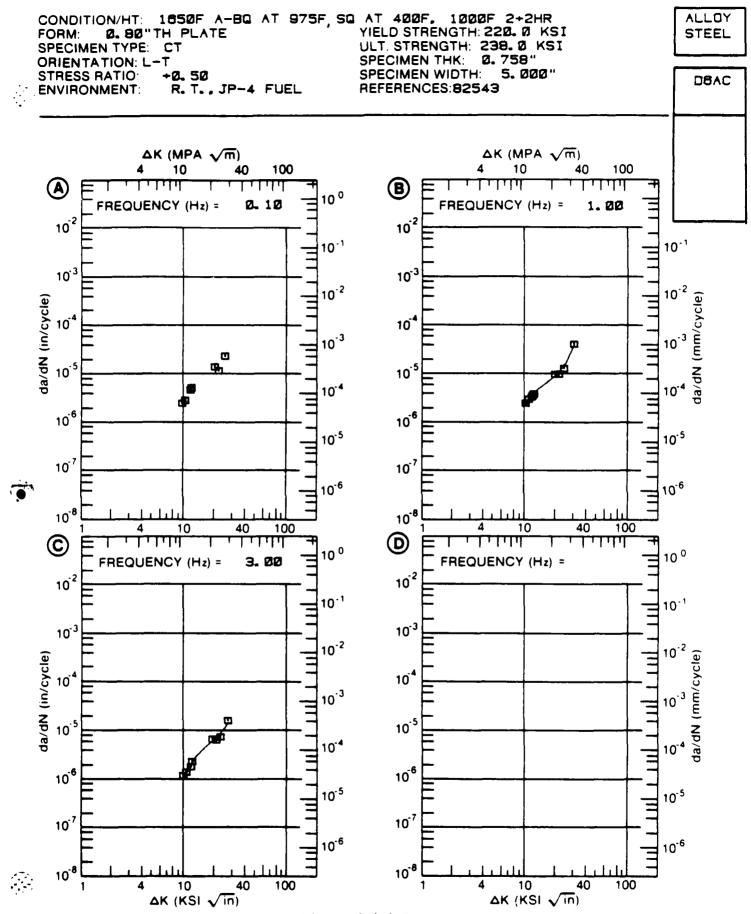
DATA ASSOCIATED WITH FIGURE 6.4.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1650F A-BQ AT 975F, SQ AT 400F, 1000F
          2+2HR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R. T. JP-4 FUEL			
A:	14.94	3.56			
DELTA K B:					
MIN C:					
D:					
	16.00	3.15			
	20.00	5.38			
	25.00	11.2			
A:	25.91	11.5			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	16.96

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

6.4-46

CONDITION/HT: 1650F A-BQ AT 975F, SQ AT 400F, 1000F 2+2HR
FORM: 0.80"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.500"
REFERENCES: 82543

ALLOY STEEL.

D6AC

Figure 6.4.3.10

TABLE 6.4.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
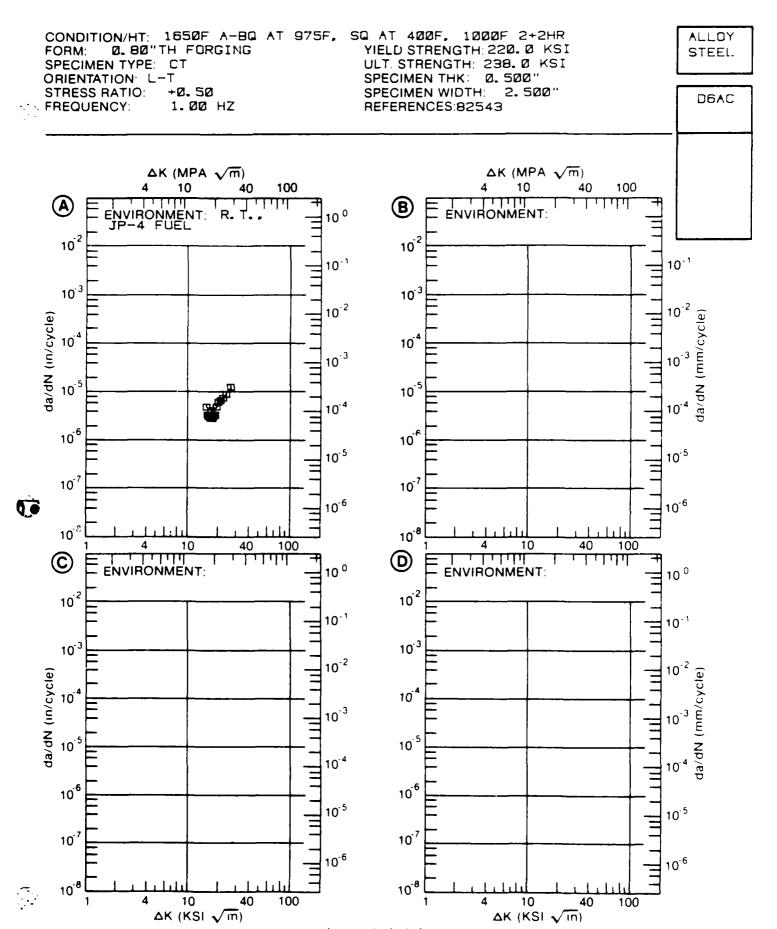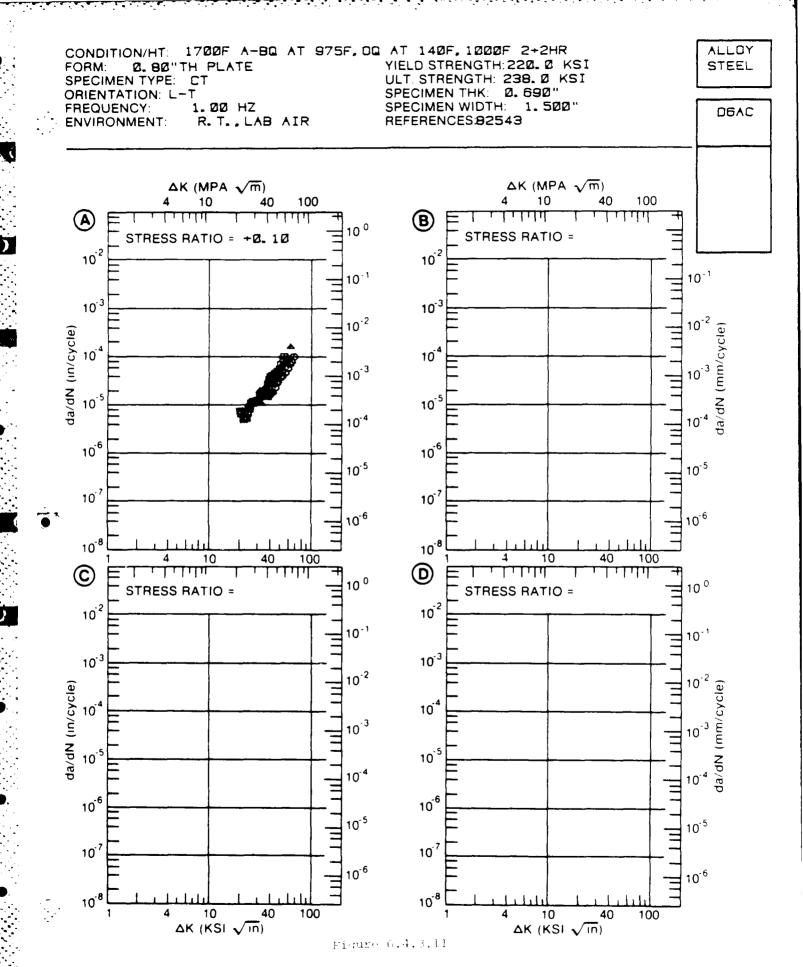
DATA ASSOCIATED WITH FIGURE 6.4.3.11 INDICATING EFFECT
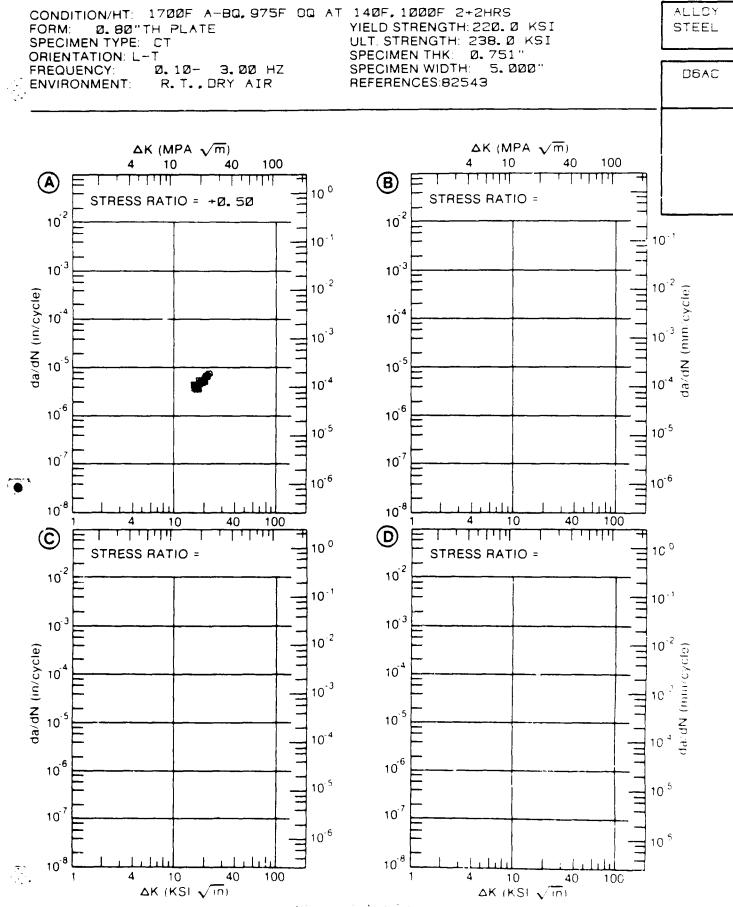
OF STRESS RATIO

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F,OQ AT 140F,1000F
           2+2HR
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	R=+0.10			
A: 19.72	5.50			
DELTA K B:				
MIN C:				
D:				
20.00	5.61			
25.00	8.34			
30.00	12.8			
35.00	19.2			
40.00	27.7			
50.00	51.3			
60.00	81.9			
A: 66.91	105.			
DELTA K B:				
MAX C:				
D:				

ROOT MEAN SQUARE PERCENT ERROR	25.51

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	1
RATIO	0.8-1.25	2
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH:220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.690"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 1.500"
ENVIRONMENT: R.T., LAB AIR   REFERENCES:82543

ALLOY
STEEL

D6AC

Figure 6.4.3.11

6.4-11

TABLE 6.4.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.12 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS
ENVIRONMENT: R.T. , DRY AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.50			
DELTA K MIN	A:	15.55	3.63			
	B:					
	C:					
	D:					
		16.00	3.76			
		20.00	6.18			
DELTA K MAX	A:	21.35	7.29			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	8.68

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	2
	1.25-2.0	1
	>2.0	

CONDITION/HT: 1700F A-BQ, 975F OQ AT 140F, 1000F 2+2HRS
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.751"
FREQUENCY: 0.10- 3.00 HZ   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., DRY AIR   REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure ...

TABLE 6.4.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
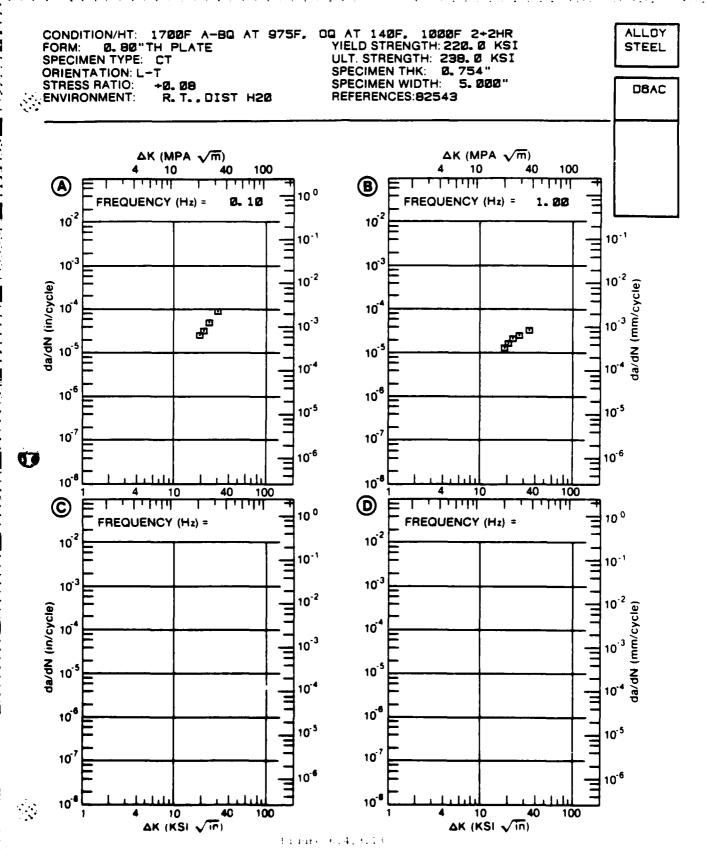
DATA ASSOCIATED WITH FIGURE 6.4.3.13 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
           2+2HR
ENVIRONMENT: R.T. , DIST H20

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	F(HZ)= 0.10	F(HZ)= 1.00		
DELTA K MIN A:	:				
DELTA K MIN B:	:				
DELTA K MIN C:	:				
DELTA K MIN D:	:				
200.00	:				
DELTA K MAX A:	:				
DELTA K MAX B:	:				
DELTA K MAX C:	:				
DELTA K MAX D:	:				

ROOT MEAN SQUARE PERCENT ERROR	0.00	0.00		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
ENVIRONMENT: R.T., DIST H20

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.754"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY
STEEL

D6AC

TABLE 6.4.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
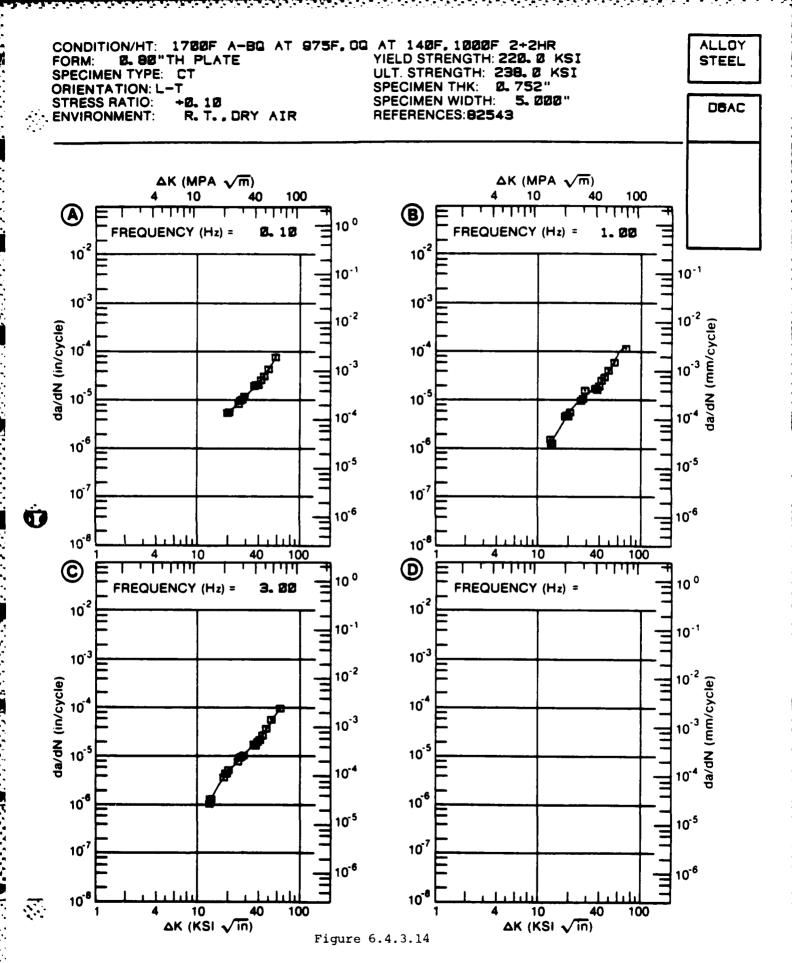
DATA ASSOCIATED WITH FIGURE 6.4.3.14 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, QQ AT 140F, 1000F
          2+2HR
ENVIRONMENT: R.T. , DRY AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
A:	19.47	4.95			
DELTA K B:	12.94		1.27		
MIN C:	12.88			1.09	
D:					
	13.00		1.26	1.14	
	16.00		2.61	2.52	
	20.00	5.28	5.88	4.86	
	25.00	8.52	9.94	8.22	
	30.00	12.3	13.6	12.1	
	35.00	17.0	17.6	16.9	
	40.00	23.2	23.0	23.2	
	50.00	43.9	43.4	43.3	
	60.00		96.3	83.0	
	70.00		128.		
A:	57.66	73.2			
DELTA K B:	70.52		114.		
MAX C:	63.32			104.	
D:					
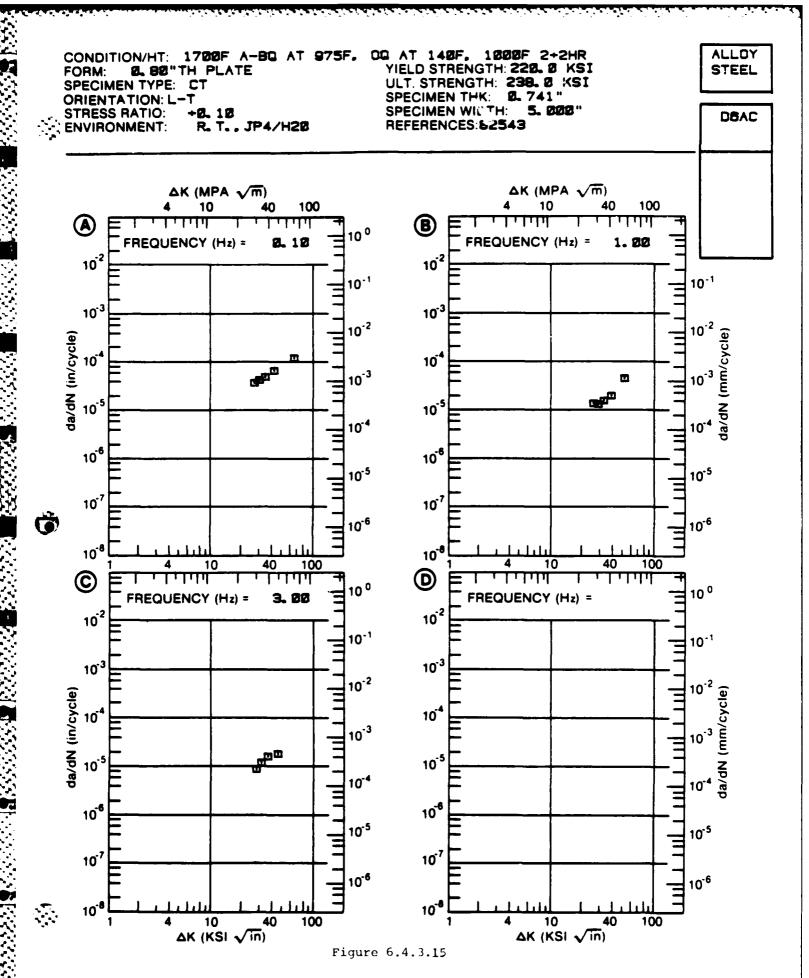
ROOT MEAN SQUARE PERCENT ERROR	4.94	11.47	6.89	

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.752"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.14

6.4-55

TABLE 6.4.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.15 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
            2+2HR
ENVIRONMENT: R. T. , JP4/H20

DELTA K	:	DA/DN (10**-6 IN. /CYCLE)			
(KSI*IN**1/2)	:				
	:	A	B	C	D
	:	F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
A:	:				
DELTA K B:	:				
MIN C:	:				
D:	:				
200.00	:				
A:	:				
DELTA K B:	:				
MAX C:	:				
D:	:				

| ROOT MEAN SQUARE | 0. 00 | 0. 00 | 0. 00 |
| PERCENT ERROR | | | |

LIFE	0. 0-0. 5
PREDICTION	0. 5-0. 8
RATIO	0. 8-1. 25
SUMMARY	1. 25-2. 0
(NP/NA)	>2. 0

CONDITION/HT: 1700F A-BQ AT 975F, QQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.741"
STRESS RATIO: +0.10   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., JP4/H20   REFERENCES: 62543

ALLOY
STEEL

D6AC

Figure 6.4.3.15

6.4-57

TABLE 6.4.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.16 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
           2+2HR
ENVIRONMENT: R. T. , DIST H2O

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN. /CYCLE)			
		A	B	C	D
		F(HZ)= 1.00	F(HZ)= 3.00		
DELTA K MIN	A: 9.81	2.20			
	B: 9.86		1.32		
	C:				
	D:				
	10.00	2.33	1.43		
	13.00	4.71	4.18		
	16.00	7.69	6.44		
	20.00	12.2	8.56		
	25.00	18.4	11.8		
	30.00	24.9	18.6		
DELTA K MAX	A: 33.23	29.1			
	B: 30.17		18.9		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	16.48	19.47		

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0		1	
(NP/NA)	>2.0	1		

6.4-58

CONDITION/HT: 1700F A-BQ AT 975F. OQ AT 140F. 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.751"
STRESS RATIO: +0.50   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., DIST H2O REFERENCES:82543

ALLOY
STEEL

D6AC

Figure 6.4.3.16

6.4-59

TABLE 6.4.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
          2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
	A:					
DELTA K	B:	10.80		2.19		
MIN	C:	10.58			1.20	
	D:					
		13.00		3.02	2.29	
		16.00		4.92	3.93	
		20.00		8.95	6.73	
		25.00		15.9	12.0	
		30.00		23.4	21.0	
		35.00		29.2		
	A:					
DELTA K	B:	39.01		31.7		
MAX	C:	33.66			31.9	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			0.00	15.29	13.65	

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25		1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1700F A-BQ AT 975F OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH PLATE   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.750"
STRESS RATIO: +0.50   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., JP-4 FUEL   REFERENCES:82543

ALLOY
STEEL

D6AC

Figure 6.4.3.17

6.4-61

TABLE 6.4.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
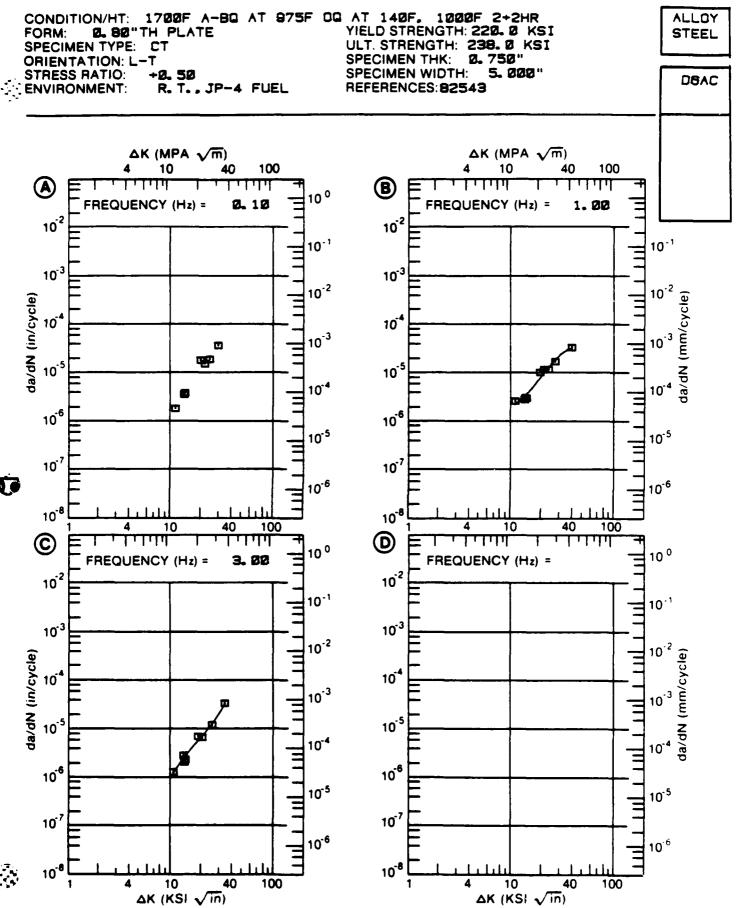
DATA ASSOCIATED WITH FIGURE 6.4.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
           2+2HR
ENVIRONMENT: R.T. , DIST H20

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
DELTA K MIN	A:	12.13	5.69			
	B:	12.01		2.35		
	C:	12.24			2.81	
	D:					
		13.00	8.66	3.25	3.40	
		16.00	16.8	6.39	4.97	
		20.00	23.4	10.7	5.88	
		25.00	41.1	15.6	7.59	
		30.00	71.7	20.5	12.6	
		35.00	109.	26.1		
		40.00	140.			
DELTA K MAX	A:	46.20	151.			
	B:	39.73		32.9		
	C:	30.48			13.5	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			16.63	15.16	34.97	

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F, 2+2HR
FORM: 0.80"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.11
ENVIRONMENT: R.T., DIST H2O

YIELD STRENGTH: 220.0 KSI
ULT. STRENGTH: 238.0 KSI
SPECIMEN THK: 0.741"
SPECIMEN WIDTH: 5.000"
REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.18

6.4-63

TABLE 6.4.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
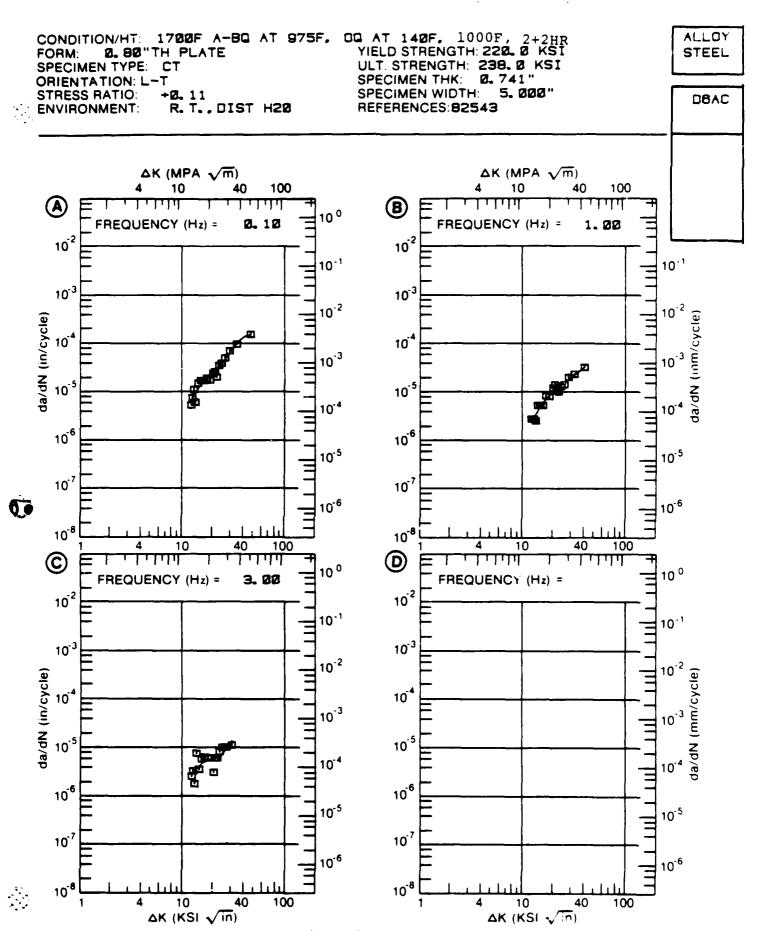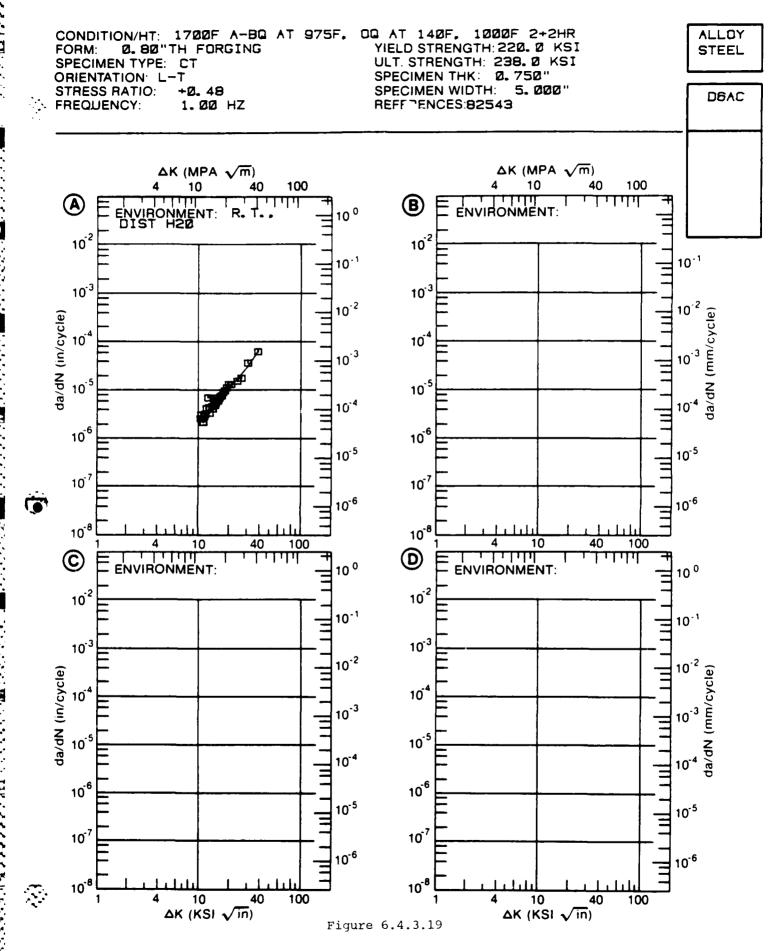
DATA ASSOCIATED WITH FIGURE 6.4.3.19 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
           2+2HR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R. T. DIST H2O			
A: 10.29	:	2.39			
DELTA K B:	:				
MIN C:	:				
D:	:				
	:				
13.00	:	4.44			
16.00	:	7.10			
20.00	:	11.4			
25.00	:	19.0			
30.00	:	30.5			
35.00	:	48.8			
A: 37.89	:	64.3			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   19.29
 PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH FORGING   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.750"
STRESS RATIO: +0.48   SPECIMEN WIDTH: 5.000"
FREQUENCY: 1.00 HZ   REFERENCES: 82543

ALLOY STEEL

D6AC

Figure 6.4.3.19

TABLE 6.4.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
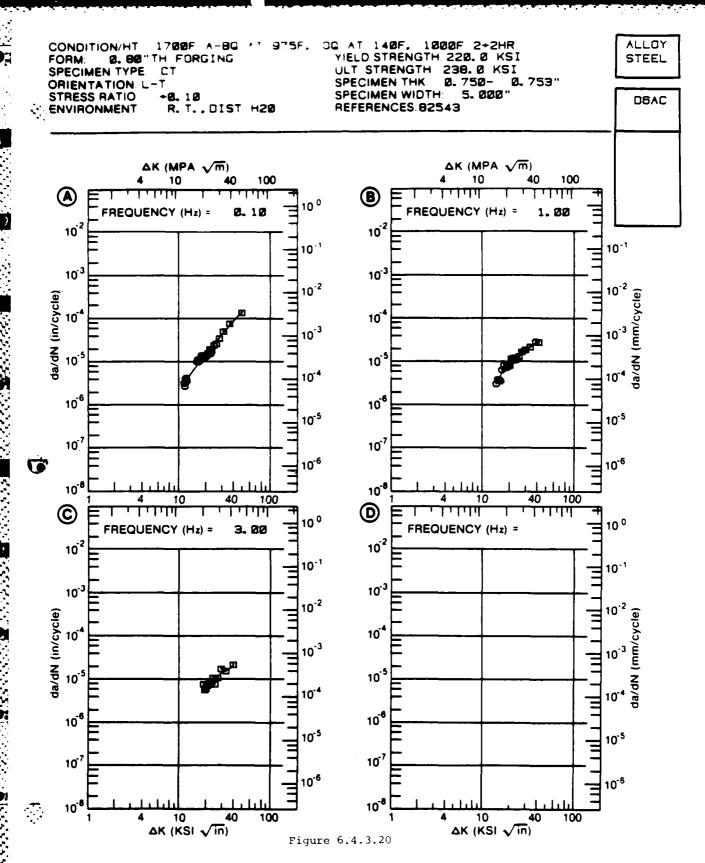
DATA ASSOCIATED WITH FIGURE 6.4.3.20 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
           2+2HR
ENVIRONMENT: R.T. ,DIST H2O

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
	A:	11.33 :	3.18			
DELTA K B:		13.93 :		3.08		
MIN C:		18.38 :			6.58	
	D:	:				
		13.00 :	4.80			
		16.00 :	8.65	5.20		
		20.00 :	15.7	9.51	6.47	
		25.00 :	27.8	14.3	10.6	
		30.00 :	43.7	18.7	15.0	
		35.00 :	63.7	23.5	16.7	
		40.00 :	88.2	29.7		
	A:	48.33 :	140.			
DELTA K B:		41.12 :		31.4		
MAX C:		38.83 :			20.9	
	D:	:				
ROOT MEAN SQUARE PERCENT ERROR			13.57	11.95	13.92	

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	2	2	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

6.4-66

CONDITION/HT   1700F A-8Q '' 975F. OQ AT 140F. 1000F 2+2HR
FORM: 0.80"TH FORGING   YIELD STRENGTH 220.0 KSI
SPECIMEN TYPE CT   ULT STRENGTH 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK   0.750- 0.753"
STRESS RATIO   +0.10   SPECIMEN WIDTH: 5.000"
ENVIRONMENT   R.T.,DIST H20   REFERENCES:82543

ALLOY STEEL

D6AC

(A) FREQUENCY (Hz) =   0.10

(B) FREQUENCY (Hz) =   1.00

(C) FREQUENCY (Hz) =   3.00

(D) FREQUENCY (Hz) =

Figure 6.4.3.20

TABLE 6.4.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.4.3.21 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   D6AC
CONDITION: 1700F A-BQ AT 975F, OQ AT 140F, 1000F
          2+2HR
ENVIRONMENT: R.T. , JP-4 FUEL

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 3.00	
	A:	11.55	1.25			
DELTA K	B:	18.43		7.19		
MIN	C:	18.87			3.10	
	D:					
		13.00	2.52			
		16.00	6.78			
		20.00	14.8	8.37	3.73	
		25.00	26.1	12.0	7.32	
		30.00	37.2	15.7	12.1	
		35.00	48.2	19.8	17.9	
		40.00	59.7	24.5	24.5	
		50.00	87.6	37.4	38.7	
		60.00			53.0	
		70.00			66.0	
	A:	58.94	123.			
DELTA K	B:	52.16		41.1		
MAX	C:	72.93			69.5	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			17.83	6.86	17.19	

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	2	1	1
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1700F A-BQ AT 975F, OQ AT 140F, 1000F 2+2HR
FORM: 0.80"TH FORGING   YIELD STRENGTH: 220.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 238.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.750- 0.753"
STRESS RATIO: +0.10   SPECIMEN WIDTH: 5.000"
ENVIRONMENT: R.T., JP-4 FUEL   REFERENCES: 82543

ALLOY
STEEL

D6AC

Figure 6.4.3.21

6.4-69

TABLE 6.4.3.22

ALLOY STEEL   D6AC   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1550F AQ 650F 4HR	S	0.16	R.T.	L-T	241.5	DIST. WATER	0.750	0.165	CANT*	0.100	61.70	7.00		> 4000	1965	63061
1550F AQ 950F 4HR	S	0.16	R.T.	L-T	217.3	DIST. WATER	0.750	0.165	CANT*	0.100	95.70	45.20		> 10000	1965	63061
1550F 25MIN OQ 830F 1+1 HR	S	0.08	R.T.	L-T	224.7	DIST. WATER	2.000	0.050	CNT	----	----	33.00*		> 5000	1968	72283
1550F 25MIN OQ 830F 1+1 HR	S	0.08	R.T.	L-T	224.7	3N NACL	2.000	0.050	CNT	----	----	33.00*		> 5000	1968	72283

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.5.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL HP 9-4-.20 AT ROOM TEMPERATURE

MEAN KIC ± STANDARD DEVIATION (KSI √IN) (NUMBER OF SPECIMENS)

PLATE

CONDITION/HT	L-T	T-L	S-L
1650F 1-2HR AC 1525F 1-2HR DO.-100F 2HR, 1025F 4-6HR	121.5 ±29.0 (2)	----	----
1650F.1-2HR.AC 1-2HR.AC.-100F 1.5HR,1025F 4 HR.1060F 6HR	123.5 ±12.0 (2)	----	----

FORGING

CONDITION/HT	L-T	T-L	S-L
----	150.6 ± 4.5 (2)	136.3 ±16.8 (2)	----
ANNEALED	120.6 ± 7.3 (12)	117.7 ± 1.9 (3)	----
HEAT TREATED	140.7 ± 4.5 (10)	132.3 ± 6.6 (7)	----
1525F DO.-100F 1HR,1065F 4+4HR	----	111.7 ± 2.0 (2)	----
1650F 1-2 HR AC.1525F 1-2 HR DO.-100F 2HR.1050F 4-6HR	133.2 ± 3.9 (5)	----	----
1650F 1-2HR AC.1525F 1-2 HR AC.-100F 1-2HR,1025F 4HR	134.8 ±12.3 (5)	109.7 ± 4.7 (3)	----
1650F 1-2HR AC 1525F 1-2HR DO.-100F 2HR, 1025F 4-6HR	142.8 ±10.7 (6)	----	----

TABLE 6.5.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HP 9-4-20 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		
	FORGING2		
CONDITION/HT	L-T	T-L	S-L
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	129.1 ± 9.7 (8)	125.3 ± 1.8 (6)	----
1650F 2HR AC, 1525F 2HR DQ, 1000F 2+2HR AC	94.4 ± 4.4 (3)	----	----
1650F 1-2HR AC 1.5HR DQ,1025F 12HR	125.5 ± 3.5 (2)	----	----
1650F,4.5HR,AC TO 900F,HELD 0.5HR,AC,-100F 1.5HR,1025F 8 HR,A-BQ	128.5 ± 0.7 (2)	----	----
1700F 4.5HR,AC 1700F 1.5HR,AC -100F 1.5HR, 1025F 4HRB	140.5 ± 0.7 (2)	----	----

6.5-2

TABLE 6.5.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS:

SPECIMEN ORIENTATION: L-T

ENVIRONMENT: L.H.A. AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
WELDED	WELDMENT	0.08	1.00					0.42	22.2	
WELDED	WELDMENT	0.30	6.00					1.02	30.4	
WELDED	WELDMENT	0.50	6.00					5.25	54.6	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	---				0.85	5.61	31.0	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	6.00					3.99		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.05	1.00					6.90	32.1	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	0.10					4.58	34.3	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	1.00					4.96	40.9	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	6.00					4.23		

TABLE 6.5.1.2 (Con't)

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-20

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT L.H.A. AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREG. (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	6.00				0.68	4.88	30.6	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	6.00				0.57	5.85	37.4	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	6.00					4.57	37.6	253
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	9.00			0.13	0.77	5.77		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.30	6.00				0.77	6.11		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.50	6.00				0.81			
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.70	6.00				1.44	7.78		

TABLE 6.5.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN
ORIENTATION: L-T

ENVIRONMENT: 100% HUM
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2.5	5	10	20	50	100
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	7.00			.932	6.26		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	0.10				6.63	38.5	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	1.00			0.62	7.39	40.6	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	1.00				8.77	46.4	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.30	1.00			0.95	7.69		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.50	1.00			1.52	8.31		

FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)

TABLE 6.5.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-20

ENVIRONMENT: S T W
AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)						
					2 5	5	10	20	50	100
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	1.00					6.94		
1525F 2HRS OQ, 100F 2HRS, 1025F 4HRS	BILLET	0.08	1.00				0 74	5.26		

TABLE 6.5.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.20

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

ENVIRONMENT: L.H.A. AT - 65 F

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS: (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	1.00					2.43	29.7	
1525F 2HRS OQ, -100F 2LHRS, 1025F 4HRS	PLATE	0.08	1.00				620	4.14		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.08	1.00					3.33	27.8	

6.5-7

TABLE 6.5.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-20

TEST CONDITIONS

SPECIMEN ORIENTATION	T-L	ENVIRONMENT	L H A AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2.5	5	10	20	50	100
1525F 2HRS AC, -100F 2HRS, 1025F 4HRS	BILLET	0.08	6.00				4.85		
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	PLATE	0.08	1.00				5.05	29.9	
1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS	BILLET	0.05	1.00					29.7	

TABLE 6.5.2.1

ALLOY STEEL   HP 9-4-.20   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
———	F	1.25	R.T.	L-T	196.5	3.995	2.000	CT	2.065	1.53	153.80			1977	MA005
		1.25			196.5	4.002	2.000	CT	2.118	1.40	147.39	150.6/	4.5	1977	MA005
———	F	1.25	R.T.	T-L	198.0	4.000	1.998	CT	2.068	1.39	148.10			1977	MA005
		1.25			198.0	3.997	2.000	CT	2.070	0.98	124.40	136.3/	16.8	1977	MA005
ANNEALED	F	3.00	R.T.	L-T	189.0	3.000	1.504	CT	1.529	0.93	115.40			1977	NC001
		3.00			189.0	4.005	2.001	CT	2.049	1.00	120.00			1977	NC001
		3.00			189.0	4.007	1.504	CT	2.038	1.15	128.39			1977	NC001
		3.00			189.0	4.003	2.001	CT	2.068	0.96	117.69			1977	NC001
		3.00			189.0	4.000	1.505	CT	2.033	0.99	119.19			1977	NC001
		3.00			189.0	2.003	0.997	CT	1.041	0.80	107.30			1977	NC001
		3.00			189.0	3.000	0.998	CT	1.522	0.94	116.10			1977	NC001
		3.00			189.0	3.000	0.998	CT	1.037	0.94	116.00			1977	NC001
		3.00			189.0	3.001	1.503	CT	1.531	0.97	118.30			1977	NC001
		3.00			192.0	3.995	2.000	CT	2.033	1.19	132.50			1976	NC001
		3.00			192.0	3.992	2.000	CT	2.059	1.09	127.30			1976	NC001
		3.00			192.0	3.996	1.999	CT	2.013	1.13	129.30	120.6/	7.3	1976	NC001
ANNEALED	F	3.00	R.T.	T-L	190.0	3.995	2.000	CT	2.080	0.98	119.30			1976	NC001
		3.00			190.0	3.998	2.000	CT	2.012	0.96	118.30			1976	NC001
		3.00			190.0	3.998	2.000	CT	2.028	0.92	115.60	117.7/	1.9	1976	NC001
HEAT TREATED	F	3.40	R.T.	L-T	185.0	4.003	1.501	CT	1.954	1.33	135.00			1973	85879
		4.00			189.0	4.000	1.503	CT	2.037	1.48	145.00			1973	85633
		4.00			190.0	3.980	1.505	CT	2.039	1.35	139.00			1973	85633
		4.00			190.0	3.971	1.506	CT	2.049	1.35	139.00			1973	85633
		4.00			190.0	3.999	1.504	CT	2.030	1.45	145.00			1973	85633
		4.00			190.0	3.995	1.504	CT	2.036	1.34	139.00			1973	85633
		4.00			191.0	4.000	1.504	CT	2.026	1.30	138.00			1973	85633
		4.00			192.0	4.002	1.504	CT	2.034	1.33	139.00			1973	85633
		4.00			192.0	4.004	1.503	CT	2.031	1.30	138.00			1973	85633
		7.00			198.0	3.990	1.511	CT	2.053	1.46	150.00	140.7/	4.5	1973	85857
HEAT TREATED	F	6.60	R.T.	T-L	186.0	3.984	1.499	CT	2.026	1.46	142.00			1973	85857

TABLE 6.5.2.1 (Con't)

ALLOY STEEL   HP 9-4-20   K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	K(IC) STAN DEV	DATE	REFER
HEAT TREATED	F	3.40	R.T.	T-L	187.0	4.000	1.501	CT	1.985	1.22	131.00			1973	85879
		3.40			187.0	4.004	1.502	CT	2.011	1.22	131.00			1973	85879
		3.40			190.0	4.005	1.499	CT	2.021	1.36	140.00			1973	85879
		3.40			196.0	4.002	1.484	CT	2.054	1.12	131.00			1973	85857
		7.00			198.0	3.989	1.464	CT	2.033	0.97	123.00			1973	85857
		7.00			198.0	3.986	1.507	CT	2.038	1.07	128.00	132.3/	6.6	1973	85857
1525F OQ.-100F 1HR,1065F 4+4HR	F	4.00	R.T.	T-L	179.0	3.996	1.497	CT	2.003	0.95	110.30			1974	90012
		4.00			179.0	3.995	1.498	CT	2.030	1.00	113.10	111.7/	2.0	1974	90012
1650F 1-2 HR AC.1525F 1-2 HR AC.-100F HR OQ.-100F 2HR,1050F 4-6HR	F	3.25	R.T.	L-T	184.0	5.248	1.506	CT	2.543	1.42	139.00			1973	86428
		3.00			186.0	4.495	1.505	CT	2.277	1.26	132.00			1973	86428
		3.25			189.0	4.499	1.502	CT	2.275	1.17	129.00			1973	86428
		3.25			187.0	5.245	1.511	CT	2.563	2.50	131.00			1973	86428
		3.25			190.0	4.500	1.501	CT	2.287	1.26	135.00	133.2/	3.9	1973	86428
1650F 1-2HR AC.1525F 1-2 HR AC.-100F 1-2HR,1025F 4HR	F	3.70	- 65	L-T	190.0	6.000	2.000	CT	----	1.84	163.00			1974	90011
1650F 1-2HR AC.1525F 1-2 HR AC.-100F 1-2HR,1025F 4HR	F	4.00	R.T.	L-T	190.0	5.997	1.752	CT	3.044	1.02	121.00			1973	85836
		4.00			190.0	5.999	1.756	CT	3.054	1.04	122.00			1973	85836
		7.00			190.0	5.999	1.995	CT	2.987	1.50	147.00			1973	85836
		7.00			190.0	6.002	1.991	CT	2.979	1.42	143.00			1973	85836
		7.00			190.0	6.000	1.997	CT	2.981	1.37	141.00	134.8/	12.3	1973	85836
1650F 1-2HR AC.1525F 1-2 HR AC.-100F 1-2HR,1025F 4HR	F	3.70	- 65	T-L	190.0	6.000	2.000	CT	----	1.21	132.00			1974	90011
1650F 1-2HR AC.1525F 1-2 HR AC.-100F 1-2HR,1025F 4HR	F	4.00	R.T.	T-L	190.0	6.000	1.757	CT	3.077	0.80	108.00			1973	85836
		4.00			190.0	5.999	1.755	CT	3.071	0.78	106.00			1973	85836
		7.00			190.0	6.005	1.992	CT	3.006	0.92	115.00	109.7/	4.7	1973	85836

TABLE 6.5.2.1 (Con't)

ALLOY STEEL   HP 9-4-.20   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1650F 1-2HR AC	P	2.50	-65	L-T	195.0	6.000	2.000	CT	----	0.75	107.00		1974	90011
1525F 1-2HR		2.50			195.0	6.000	2.000	CT	----	0.72	105.00		1974	90011
DQ.-100F 2HR,		2.50			195.0	6.000	2.000	CT	----	0.53	90.00		1974	90011
1025F 4-6HR		2.50			195.0	6.000	2.000	CT	----	0.78	109.00		1974	90011
											91.00	100.4/ 9.2	1974	90011
1650F 1-2HR AC	P	2.50	R.T.	L-T	189.0	6.000	2.000	CT	----	0.71	101.00		1974	90011
1525F 1-2HR		2.50			190.0	6.000	2.002	CT	2.905	1.53	142.00	121.5/ 29.0	1972	84306
DQ.-100F 2HR, 1025F 4-6HR														
1650F 1-2HR AC	P	2.50	-65	T-L	195.0	6.000	2.000	CT	----	0.60	96.00		1974	90011
1525F 1-2HR		2.50			195.0	6.000	2.000	CT	----	0.71	104.00		1974	90011
DQ.-100F 2HR,		2.50			195.0	6.000	2.000	CT	----	0.56	92.00	97.3/ 6.1	1974	90011
1025F 4-6HR														
1650F 1-2HR AC	F	3.70	-65	L-T	190.0	5.997	1.507	CT	2.991	1.12	127.00		1973	85836
1525F 1-2HR DQ.-100F 2HR, 1025F 4-6HR														
1650F 1-2HR AC	F	4.00	R.T.	L-T	186.0	6.000	2.005	CT	2.964	1.36	140.00		1973	85836
1525F 1-2HR		4.00			186.0	6.000	2.010	CT	2.986	1.27	136.00		1973	85836
DQ.-100F 2HR,		4.00			186.0	5.998	2.010	CT	2.975	1.42	143.00		1973	85836
1025F 4-6HR		4.00			186.0	6.002	2.010	CT	2.985	1.28	136.00		1973	85836
		4.00			188.0	6.005	2.010	CT	2.984	1.32	138.00		1973	85836
						6.000	2.000	CT	----	1.90	164.00	142.8/ 10.7	1974	90011
1650F 1-2HR AC	F	3.00	R.T.	L-T	190.0	6.000	2.000	CT	----	1.34	139.00		1974	90011
1525F 1-2HR DQ.-100F 2HR, 1000F 4-6HR														
1650F 1-2HR AC	F	4.00	R.T.	L-T	194.0	4.000	1.635	CT	1.970	1.39	142.00		1972	84306
1525F 1-2HR		4.00			194.0	3.974	1.598	CT	2.366	1.26	135.00		1972	84306
DQ.-100F 2HR,		4.00			194.0	4.014	1.506	CT	1.967	1.33	141.00		1972	84306
1025F 4-6HR		4.00			198.0	5.000	2.000	CT	----	1.01	126.00		1974	90011
		4.00			198.0	5.000	2.000	CT	----	0.96	123.00		1974	90011
		4.00			198.0	5.000	2.000	CT	----	1.08	130.00		1974	90011
		4.00			198.0	5.000	2.000	CT	----	0.84	115.00		1974	90011
		4.00			198.0	5.000	2.000	CT	----	0.93	121.00	129.1/ 9.7	1974	90011
1650F 1-2HR AC	F	4.00	82	L-T	190.0	6.000	1.740	CT	2.983	1.01	121.00		1973	85836
1525F 1-2HR DQ.-100F 2HR, 1025F 4-6HR														

TABLE 6.5.2.1 (Con't)

ALLOY STEEL   HP 9-4-.20   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYB)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	F	4.00	B2	L-T	190.0	6.000	1.743	CT	2.971	1.19	131.00	126.0/	7.1	1973	85836
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	F	4.00	R.T.	T-L	190.0	6.002	2.011	CT	2.977	1.11	126.00			1973	85836
					190.0	6.002	2.004	CT	2.963	1.11	127.00			1973	85836
					190.0	6.002	2.010	CT	2.961	1.03	122.00			1973	85836
					190.0	6.005	2.010	CT	2.959	1.11	126.00	125.3/	2.2	1973	85836
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1000F 4-6HR	F	3.00	R.T.	T-L	190.0	6.000	2.000	CT	----	0.72	102.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	F	4.00	R.T.	T-L	190.0	6.006	2.006	CT	2.970	1.10	126.00			1973	85836
					194.0	4.013	1.506	CT	1.991	1.07	125.00	125.5/	0.7	1972	84306
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	F	4.00	B2	T-L	185.0	6.001	1.752	CT	3.000	0.95	114.00			1973	85836
1650F 1-2HR AC 1525F 1-2HR DQ,-100F 2HR, 1025F 4-6HR	F	4.00	R.T.	S-T	190.0	3.005	1.630	CT	1.484	0.93	116.00			1973	85836
					190.0	3.003	1.632	CT	1.496	0.89	114.00	115.0/	1.4	1973	85836
1650F 1-2HR.AC 1525F 1-2HR.DQ,-100F 2HR. 1025F 4-6HR	F	4.00	R.T.	L-T	186.0	6.003	2.010	CT	2.963	1.32	138.00			1973	85836
1650F 1-2HR.AC 1525F 1-2HR.DQ,-100F 2HR,1050F 4-6HR	F	1.70	R.T.	T-L	190.0	5.260	1.501	CT	2.628	1.43	143.00			1973	86428
1650F 2HR AC, 1525F 2HR DQ, 1000F 2+2HR AC	F	4.00	R.T.	L-T	186.0	2.516	1.240	CT	1.171	0.63	92.80			1974	88136
					186.0	2.523	1.244	CT	1.136	0.72	99.40			1974	88136
					186.0	2.510	1.247	CT	1.146	0.60	91.10	94.4/	4.4	1974	88136
1650F,1-2HR.AC 1-2HR.AC,-100F 1.5HR,1025F 4HR,1060F 6HR	P	2.50	R.T.	L-T	189.0	6.000	2.000	CT	----	1.22	132.00			1974	90011

6.5-12

TABLE 6.5.2.1 (Con't)

ALLOY STEEL   HP 9-4-.20   K(IC)

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	K(IC) STAN DEV	DATE	REFER
1650F,1-2HR,AC 1-2HR,AC,-100F 1.5HR,1025F 4HR,1060F 6HR	P	2.50	R.T.	L-T	189.0	6.000	2.000	CT	----	0.92	115.00	123.5/	12.0	1974	90011
1650F,1-2HR,AC 1-2HR,AC,-130F 1.5HR,1025-1075F 4HR	P	2.50	R.T.	T-L	186.0	6.000	2.000	CT	----	0.97	116.00			1974	90011
1650F,1-2HR,AC 1-2HR,AC,-100F 1.5HR,1025F 4HR,1060F 6HR	P	2.50	R.T.	T-L	189.0	6.000	2.000	CT	----	1.15	128.00			1974	90011
1650F,1-2HR,AC 1.5HR DG,1025F 12HR	F	4.00 4.00	R.T.	L-T	185.0 185.0	6.006 6.007	1.585 1.546	CT CT	2.987 2.996	1.10 1.19	123.00 128.00	125.5/	3.5	1973 1973	85836 85836
1650F,4.5HR,AC TO 900F,HELD 0.5HR,AC,-100F 1.5HR,1025F BHR,A-BQ	F	4.00 4.00	R.T.	L-T	185.0 185.0	6.004 6.000	1.609 1.590	CT CT	3.020 3.031	1.19 1.22	128.00 129.00	128.5/	0.7	1973 1973	85836 85836
1700F 4.5HR,AC 1700F 1.5HR,AC -100F 1.5HR,1025F 4HRS	F	4.00 4.00	R.T.	L-T	185.0 185.0	6.003 6.005	1.596 1.605	CT CT	3.006 3.031	1.45 1.43	141.00 140.00	140.5/	0.7	1973 1973	85836 85836

TABLE 6.5.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR 10HZ	E= R.T. 3.5% NACL 1HZ		
DELTA K MIN	A: 12.17	.846			
	B: 21.23		5.00		
	C:				
	D:				
	13.00	1.04			
	16.00	1.93			
	20.00	3.58			
	25.00	6.40	6.42		
	30.00	10.1	11.8		
	35.00	14.6	19.9		
	40.00	19.9	26.7		
	50.00	33.2	36.6		
	60.00	50.0	52.3		
	70.00		89.4		
	80.00		133.		
DELTA K MAX	A: 66.04	62.1			
	B: 91.85		137.		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		7.64	10.79		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5 0.5-0.8 0.8-1.25 1.25-2.0 >2.0	1	1		

CONDITION/HT:
FORM:　2.50"TH BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO:　+0.02
FREQUENCY:

YIELD STRENGTH:185.5 KSI
ULT. STRENGTH: 201.0 KSI
SPECIMEN THK:　1.250"
SPECIMEN WIDTH:　5.000"
REFERENCES:88136

ALLOY
STEEL

HP9-4-
.20

A ENVIRONMENT: R.T..
LAB AIR
10HZ

B ENVIRONMENT: R.T..
3.5% NACL
1HZ

C ENVIRONMENT:

D ENVIRONMENT:

Figure 6.5.3.1

6.5-15

TABLE 6.5.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION:

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:				
	:	E= R.T. :LAB AIR .1-20HZ	E= R.T. SIM SEA WATER .1-15HZ		
A: 8.36	:	.0938			
DELTA K B: 21.08	:		2.87		
MIN C:	:				
D:	:				
9.00	:	.123			
10.00	:	.180			
13.00	:	.435			
16.00	:	.833			
20.00	:	1.61			
25.00	:	3.01	4.77		
30.00	:	4.93	8.01		
35.00	:	7.41	12.2		
40.00	:	10.5	17.4		
50.00	:	18.9	31.2		
60.00	:	30.6	50.0		
70.00	:	46.3	74.4		
80.00	:	66.8	105.		
90.00	:	93.0	144.		
100.00	:	126.	191.		
130.00	:	278.	395.		
160.00	:	542.	727.		
A: 192.57	:	1026.			
DELTA K B: 192.73	:		1299.		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	13.48	22.71

LIFE   0.0-0.5
PREDICTION 0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION· L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH:196.5 KSI
ULT. STRENGTH: 209.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:MA005

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.2

TABLE 6.5.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. : LAB AIR .1-20HZ	E= R.T. SIM SEA WATER .1-15HZ		
DELTA K MIN	A: 8.87	.131			
	B: 18.18		1.57		
	C:				
	D:				
	9.00	.141			
	10.00	.242			
	13.00	.751			
	16.00	1.55			
	20.00	2.99	2.31		
	25.00	5.31	4.97		
	30.00	8.25	8.36		
	35.00	12.0	12.4		
	40.00	16.7	17.2		
	50.00	30.7	29.9		
	60.00	54.5	49.4		
	70.00	95.3	80.3		
	80.00	165.	131.		
	90.00	285.	213.		
	100.00	490.	350.		
	130.00		1599.		
DELTA K MAX	A: 120.15	1437.			
	B: 153.57		5368.		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		14.01	20.32		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: T-L
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH:198.0 KSI
ULT. STRENGTH: 212.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:MA005

Figure 6.5.3.3

TABLE 6.5.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: WELDED
ENVIRONMENT: R. T. , L. H. A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.30	R=+0.50		
DELTA K MIN	A:	15.75	.287			
	B:	11.48		.502		
	C:					
	D:					
		13.00		.992		
		16.00	.314	2.48		
		20.00	1.02	5.25		
		25.00	2.82	9.46		
		30.00	5.81	14.4		
		35.00	10.1	20.6		
		40.00	15.6	28.6		
		50.00	30.4	54.6		
		60.00	50.4			
DELTA K MAX	A:	62.95	57.3			
	B:	51.28		59.4		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			6.61	6.65		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: WELDED
FORM: WELDMENT
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T. . L. H. A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.490-   0.500"
SPECIMEN WIDTH: 6.010"
REFERENCES:88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.4

TABLE 6.5.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.5 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: WELDED
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.08			
		:				
DELTA K MIN	A: 18.87	:	.365			
	B:	:				
	C:	:				
	D:	:				
		:				
	20.00	:	.422			
	25.00	:	1.77			
	30.00	:	4.62			
	35.00	:	7.55			
	40.00	:	10.9			
	50.00	:	22.2			
		:				
DELTA K MAX	A: 54.51	:	28.3			
	B:	:				
	C:	:				
	D:	:				

ROOT MEAN SQUARE PERCENT ERROR	7.92

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: WELDED
FORM: WELDMENT
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.510"
SPECIMEN WIDTH: 6.000"
REFERENCES:88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.5

6.5-23

TABLE 6.5.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS AC, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A., 6HZ	E= R.T. 100% HUM, 1HZ		
DELTA K MIN	A: 12.74	1.41			
	B: 10.61		.809		
	C:				
	D:				
	13.00	1.48	1.72		
	16.00	2.49	3.26		
	20.00	4.23	5.77		
	25.00	7.09	9.51		
	30.00	10.8	14.0		
	35.00	15.3	19.5		
	40.00	20.8	26.3		
	50.00		46.4		
DELTA K MAX	A: 48.33	32.4			
	B: 54.53		59.4		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		4.31	6.66		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1525F 2HRS AC. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH: 176.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 201.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.990"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 6.000"
FREQUENCY: REFERENCES: 88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.6

TABLE 6.5.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS AC,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.08			
DELTA K MIN	A: 11.94	1.15			
	B:				
	C:				
	D:				
	13.00	1.52			
	16.00	2.77			
	20.00	4.85			
	25.00	8.01			
	30.00	11.8			
	35.00	16.4			
	40.00	21.9			
DELTA K MAX	A: 49.98	36.8			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	3.60

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1525F 2HRS AC. –100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH: 178.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 209.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.990"
FREQUENCY: 6.00 HZ   SPECIMEN WIDTH: 6.000"
ENVIRONMENT: R. T.. L. H. A.   REFERENCES: 88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.7

TABLE 6.5.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.8 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OG, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R. T. , L. H. A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.08			
DELTA K MIN	A:	14.91	1.68			
	B:					
	C:					
	D:					
		16.00	2.18			
		20.00	3.99			
		25.00	6.04			
		30.00	8.45			
		35.00	12.2			
		40.00	18.9			
DELTA K MAX	A:	46.67	37.7			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	8.01			

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1		
	1.25-2.0			
	>2.0			

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE   YIELD STRENGTH:189.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 201.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.830"
FREQUENCY: 6.00 HZ   SPECIMEN WIDTH: 5.990"
ENVIRONMENT: R. T., L. H. A.   REFERENCES:88579

Figure 6.5.3.8

TABLE 6.5.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A. 6HZ	E= R.T. DIST. H2O 0.1HZ		
DELTA K MIN	A: 8.50	.445			
	B: 12.13		1.92		
	C:				
	D:				
	9.00	.565			
	10.00	.859			
	13.00	2.14	2.43		
	16.00	3.72	4.68		
	20.00	5.61	8.73		
	25.00	7.75	15.2		
	30.00	10.2	22.9		
	35.00	13.7	31.7		
	40.00	18.3	41.4		
	50.00	31.0	64.0		
	60.00	48.0	90.8		
	70.00		122.		
	80.00		159.		
	90.00		203.		
	100.00		254.		
DELTA K MAX	A: 65.72	59.3			
	B: 106.00		288.		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR		14.55	3.67		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	2	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1525F 2HRS OQ.-100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY:

YIELD STRENGTH: 188.0- 189.0 KSI
ULT. STRENGTH: 200.0- 201.0 KSI
SPECIMEN THK: 0.990- 1.000"
SPECIMEN WIDTH: 7.400- 7.410"
REFERENCES: 88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.9

TABLE 6.5.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=- 65F L.H.A.	E= R.T. 100% HUM	E= R.T. S.T.W.	
DELTA K MIN	A:	8.84	.483			
	B:	8.69		.711		
	C:	11.00			1.43	
	D:					
		9.00	.513	.754		
		10.00	.719	.932		
		13.00	1.50	1.84	2.34	
		16.00	2.47	3.37	4.08	
		20.00	4.03	6.26	6.94	
		25.00	6.45	10.2	11.1	
		30.00	9.55		15.4	
		35.00	13.6			
		40.00	18.8			
		50.00	34.0			
		60.00	54.2			
DELTA K MAX	A:	66.62	68.4			
	B:	26.15		11.0		
	C:	34.39			19.3	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			10.79	16.06	16.33	

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25   2   1   1
SUM   1.25-2.0
(NP/NA)

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.08
FREQUENCY: 1.00 HZ

YIELD STRENGTH:188.0- 191.0 KSI
ULT. STRENGTH: 200.0- 201.0 KSI
SPECIMEN THK: 0.993- 1.000"
SPECIMEN WIDTH: 7.400"
REFERENCES:88579. 85837

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.1

TABLE 6.5.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
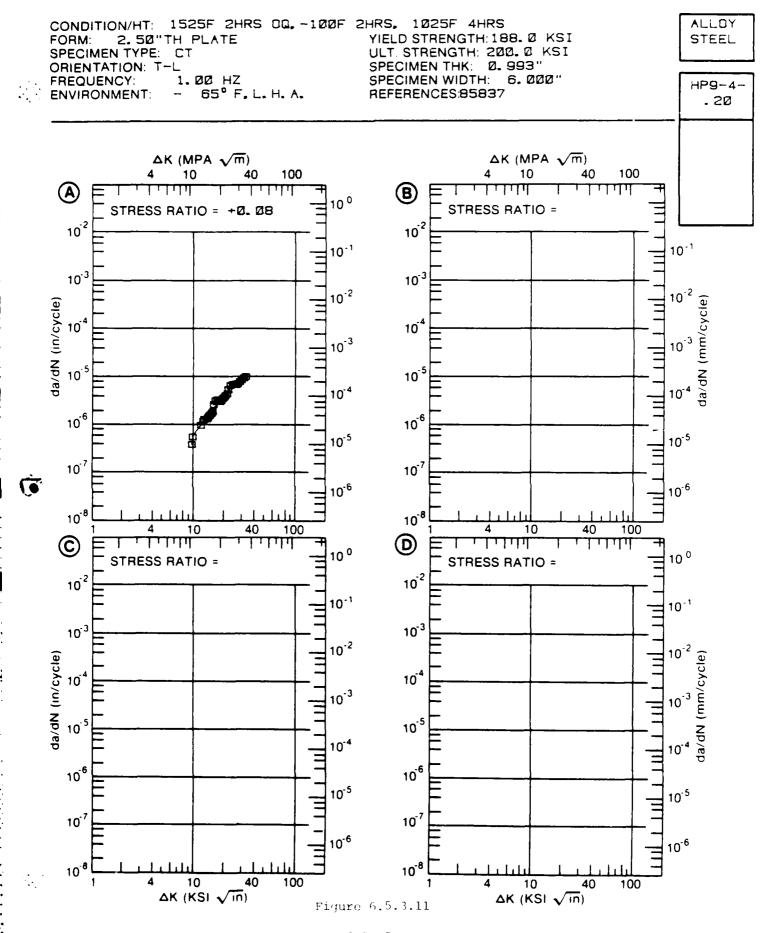
DATA ASSOCIATED WITH FIGURE 6.5.3.11 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OG,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: - 65F,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.08			
DELTA K MIN	A:	9.54	.473			
	B:					
	C:					
	D:					
		10.00	.620			
		13.00	1.29			
		16.00	2.31			
		20.00	4.14			
		25.00	6.65			
		30.00	8.61			
DELTA K MAX	A:	32.43	9.20			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE   10.93
  PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 2.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 1.00 HZ
ENVIRONMENT: - 65° F. L. H. A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 200.0 KSI
SPECIMEN THK: 0.993"
SPECIMEN WIDTH: 6.000"
REFERENCES: 85837

ALLOY STEEL

HP9-4-.20

Figure 6.5.3.11

TABLE 6.5.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
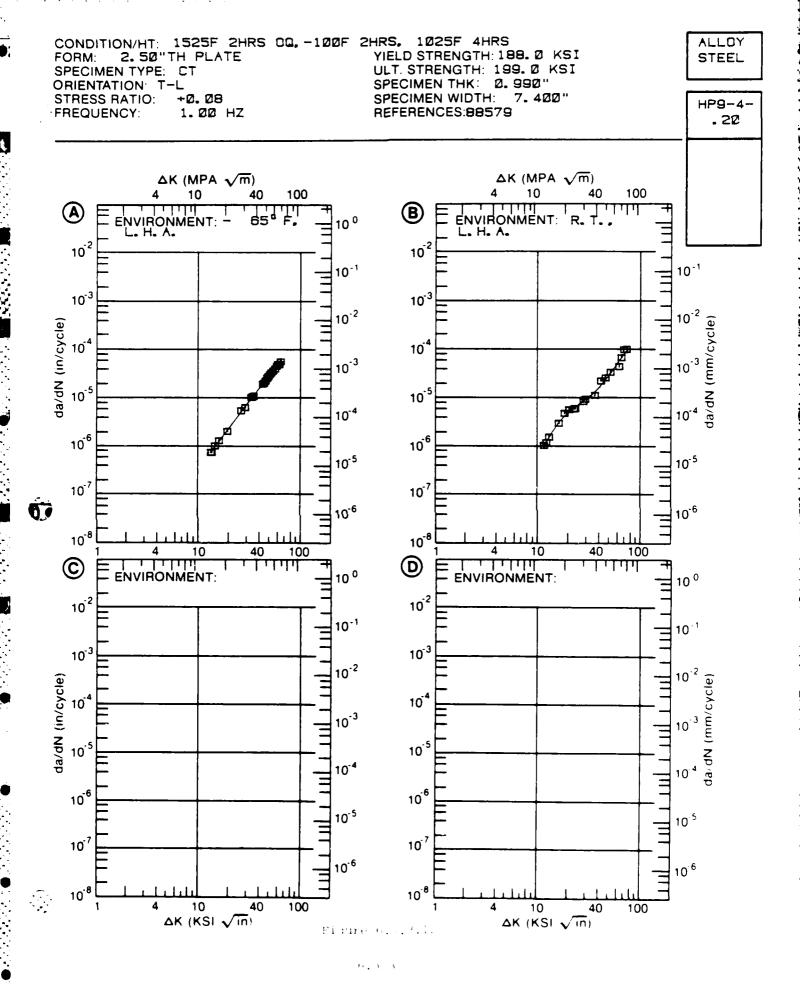
DATA ASSOCIATED WITH FIGURE 6.5.3.12 INDICATING EFFECT
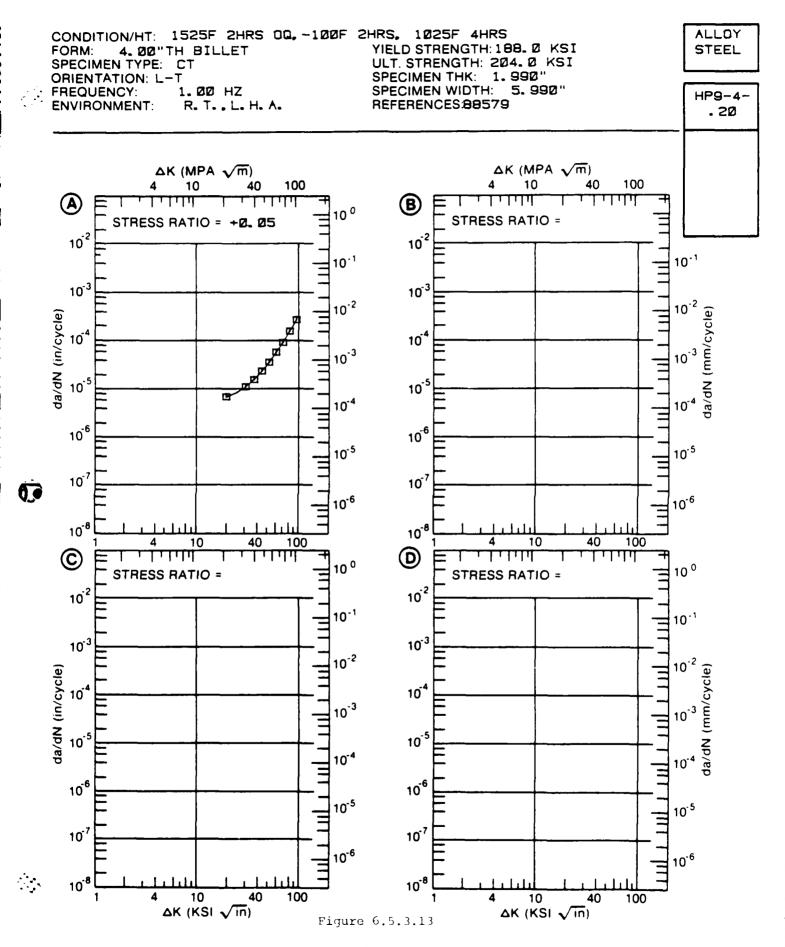
OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E=- 65F	E= R.T.		
			L.H.A.	L.H.A.		
DELTA K MIN	A:	13.08	.738			
	B:	11.34		.968		
	C:					
	D:					
		13.00		1.62		
		16.00	1.30	3.12		
		20.00	2.43	5.05		
		25.00	4.55	7.19		
		30.00	7.54	9.43		
		35.00	11.5	12.3		
		40.00	16.5	16.4		
		50.00	29.7	29.9		
		60.00	47.2	51.3		
		70.00		80.0		
DELTA K MAX	A:	63.48	54.3			
	B:	72.79		89.0		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			3.87	11.94		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5					
	0.5-0.8					
	0.8-1.25		1	1		
	1.25-2.0					
	>2.0					

6.5-36

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 2.50"TH PLATE   YIELD STRENGTH: 188.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 199.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.990"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 7.400"
FREQUENCY: 1.00 HZ   REFERENCES:88579

ALLOY
STEEL

HP9-4-
.20

Figure

TABLE 6.5.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.13 INDICATING EFFECT

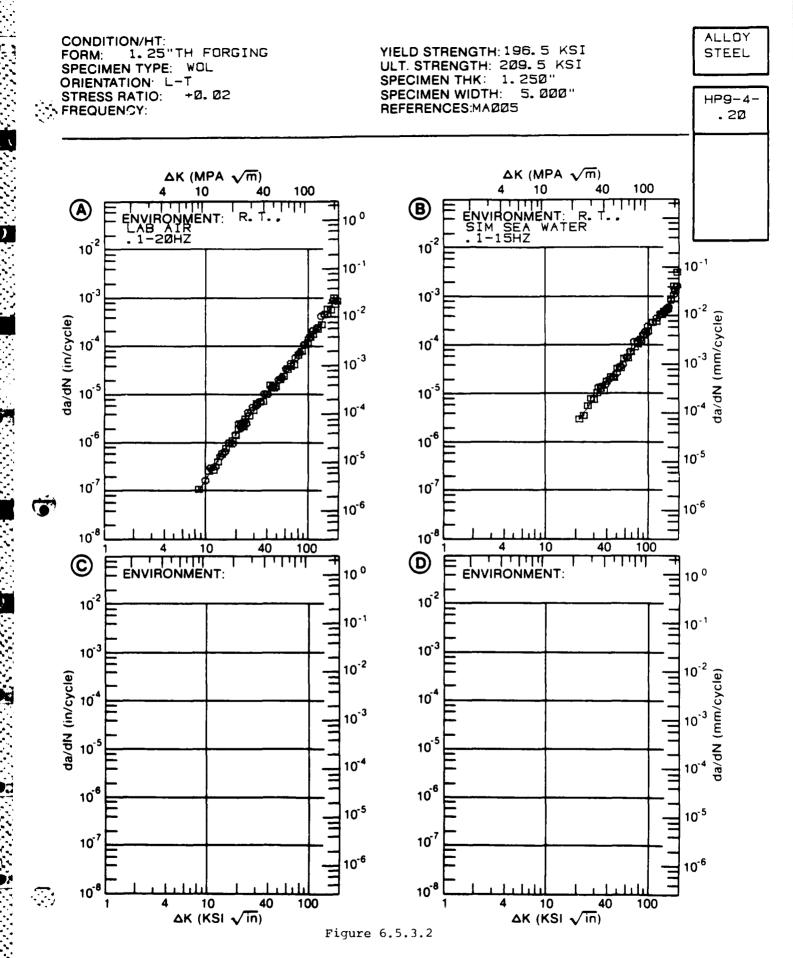### OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.05			
DELTA K MIN	A: 19.41	6.79			
	B:				
	C:				
	D:				
	20.00	6.90			
	25.00	8.40			
	30.00	10.8			
	35.00	14.1			
	40.00	18.6			
	50.00	32.1			
	60.00	53.9			
	70.00	87.6			
	80.00	138.			
	90.00	212.			
DELTA K MAX	A: 95.59	266.			
	B:				
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		16.27			

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH:188.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 204.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 1.990"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 5.990"
ENVIRONMENT: R. T.. L. H. A.   REFERENCES:88579

ALLOY STEEL

HP9-4-.20

Figure 6.5.3.13

TABLE 6.5.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
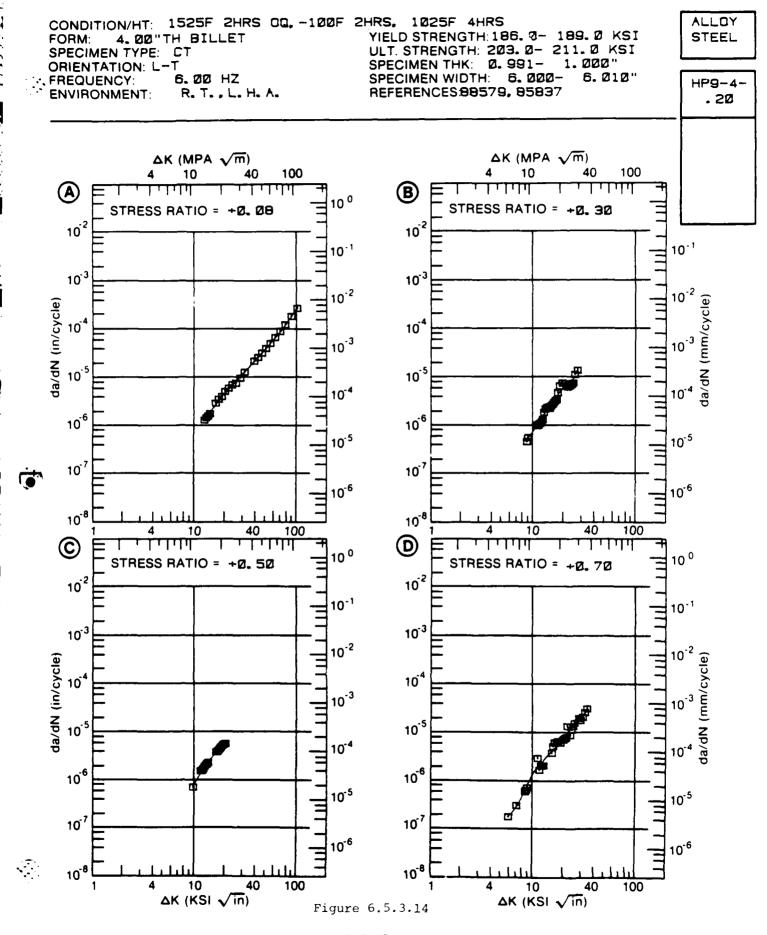
DATA ASSOCIATED WITH FIGURE 6.5.3.14 INDICATING EFFECT
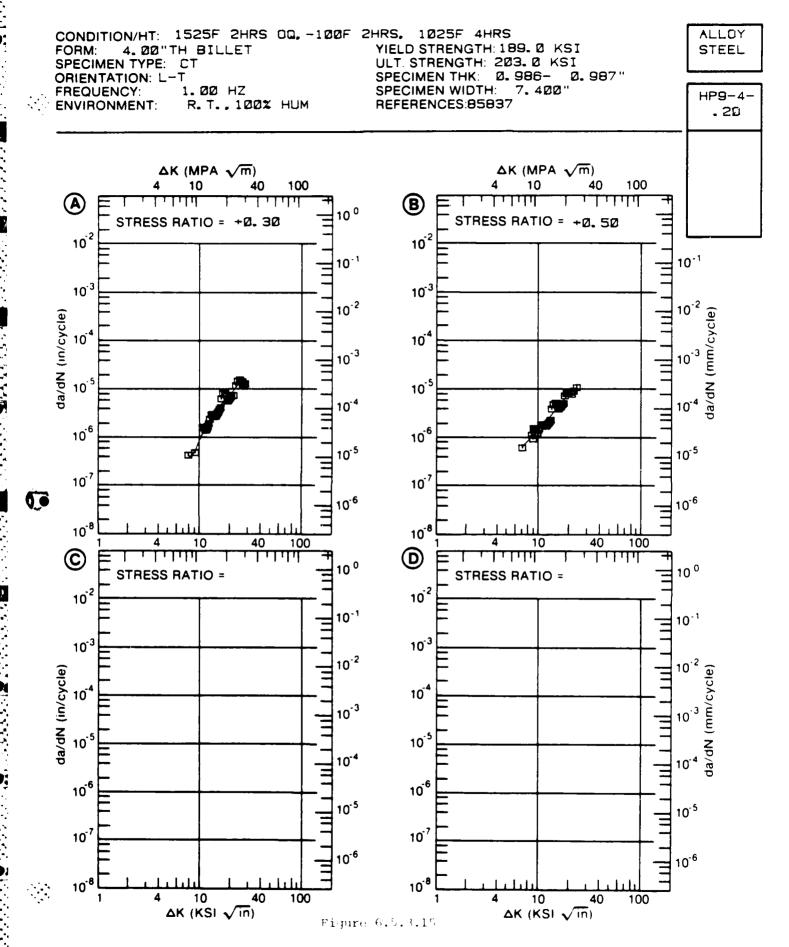
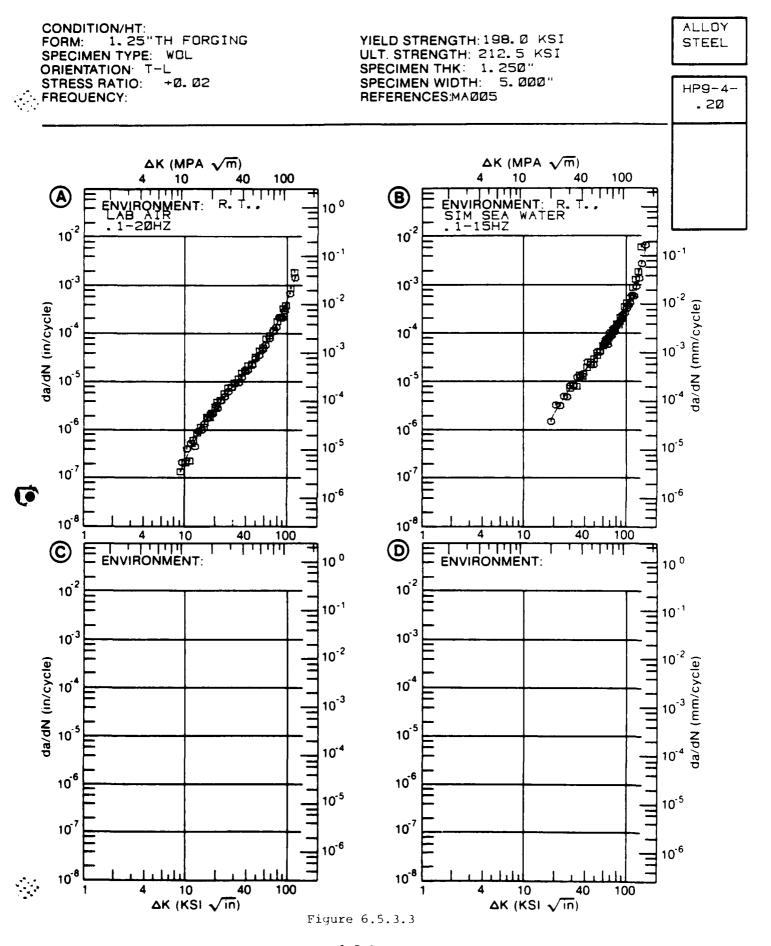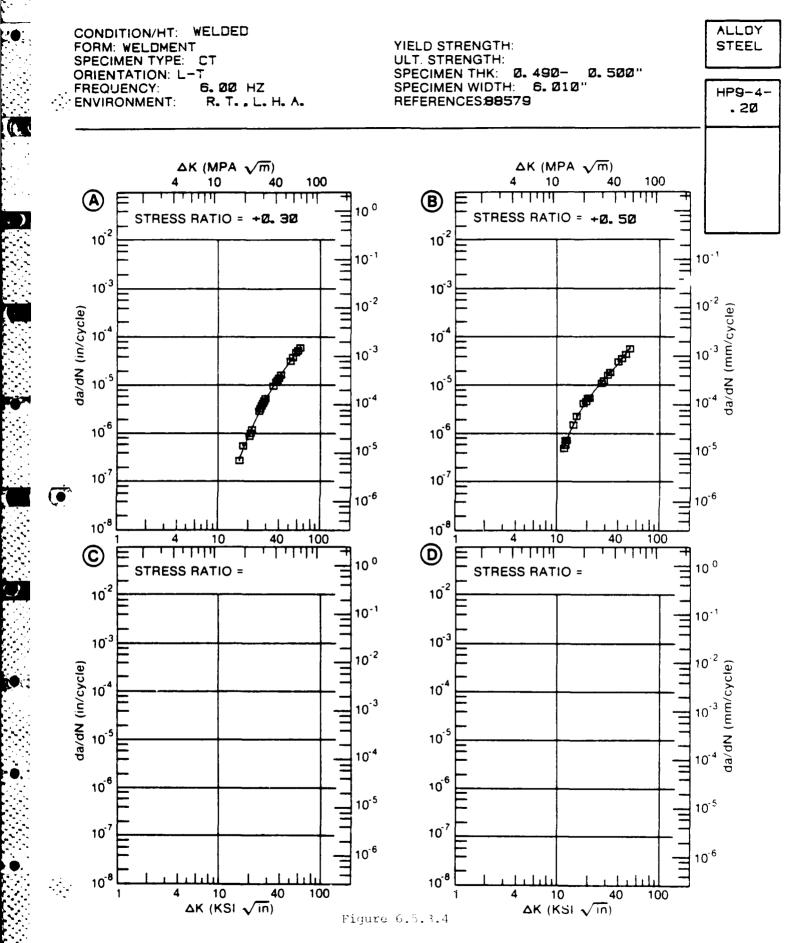#### OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.08	R=+0.30	R=+0.50	R=+0.70
DELTA K MIN	A: 12.52	1.28			
	B: 8.62		.505		
	C: 9.59			.674	
	D: 5.66				.183
	6.00				.197
	7.00				.310
	8.00				.551
	9.00		.568		.943
	10.00		.771	.819	1.44
	13.00	1.43	1.76	2.07	2.87
	16.00	2.58	3.35	3.43	4.54
	20.00	4.57	6.11		7.78
	25.00	7.77	9.32		13.6
	30.00	11.8			21.2
	35.00	16.6			
	40.00	22.4			
	50.00	37.6			
	60.00	58.7			
	70.00	87.8			
	80.00	128.			
	90.00	181.			
	100.00	253.			
DELTA K MAX	A: 102.55	275.			
	B: 27.08		10.2		
	C: 19.92			5.62	
	D: 33.41				27.3
ROOT MEAN SQUARE PERCENT ERROR		4.66	16.89	2.93	17.74
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5				
	0.5-0.8				
	0.8-1.25	1	1	1	1
	1.25-2.0				
	>2.0				

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 186. 0- 189. 0 KSI
ULT. STRENGTH: 203. 0- 211. 0 KSI
SPECIMEN THK: 0. 991- 1. 000"
SPECIMEN WIDTH: 6. 000- 6. 010"
REFERENCES: 88579, 85837

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.14

6.5-41

TABLE 6.5.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
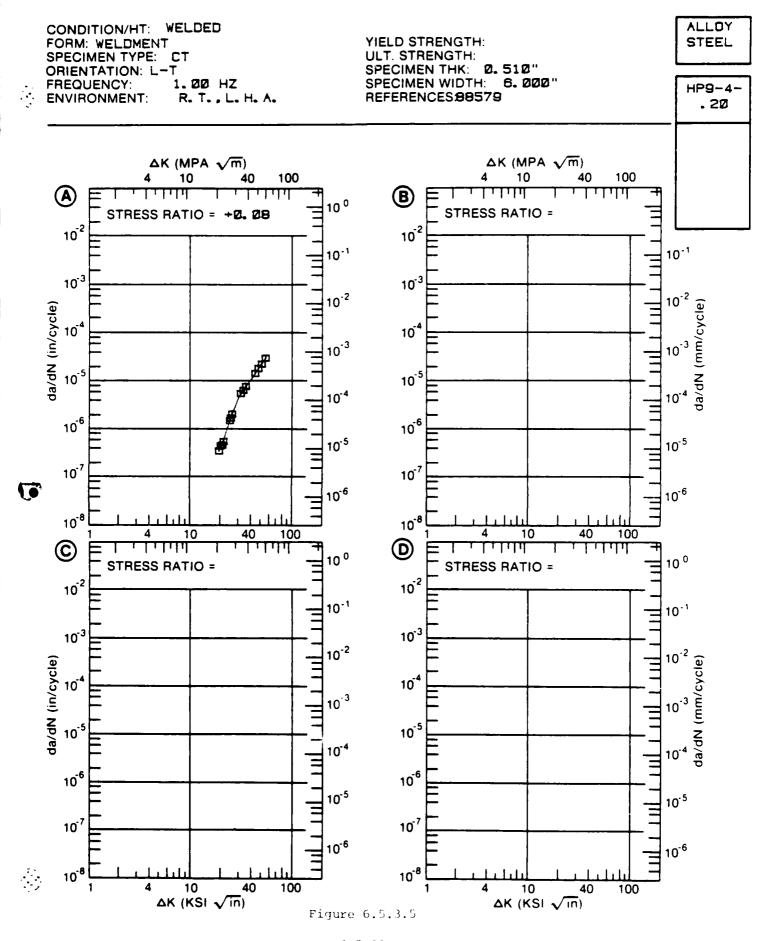
DATA ASSOCIATED WITH FIGURE 6.5.3.15 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL.   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,100% HUM

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.30	R=+0.50		
DELTA K MIN	A: 7.60	.371			
	B: 6.77		.615		
	C:				
	D:				
	7.00		.670		
	8.00	.371	.923		
	9.00	.532	1.20		
	10.00	.958	1.52		
	13.00	2.77	2.80		
	16.00	4.68	4.90		
	20.00	7.69	8.31		
	25.00	15.0			
DELTA K MAX	A: 25.00	15.0			
	B: 23.21		9.80		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		19.42	17.66		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5				
	0.5-0.8				
	0.8-1.25	1	1		
	1.25-2.0				
	>2.0				

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH:189.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 203.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.986- 0.987"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 7.400"
ENVIRONMENT: R.T.,100% HUM REFERENCES:85837

Figure 6.5.3.15

TABLE 6.5.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.16 INDICATING EFFECT

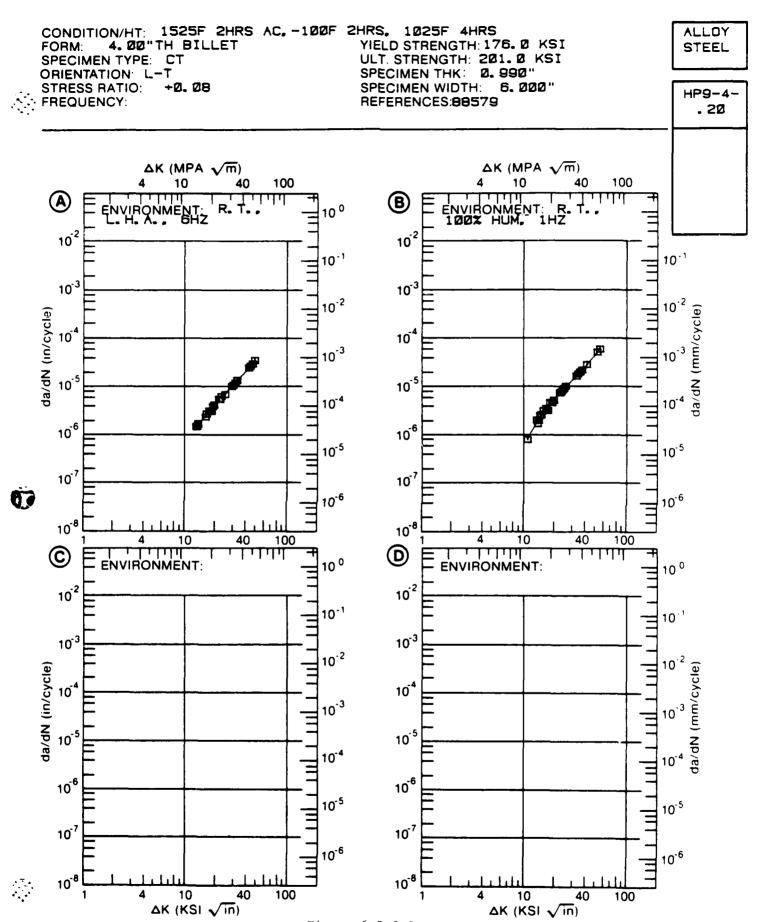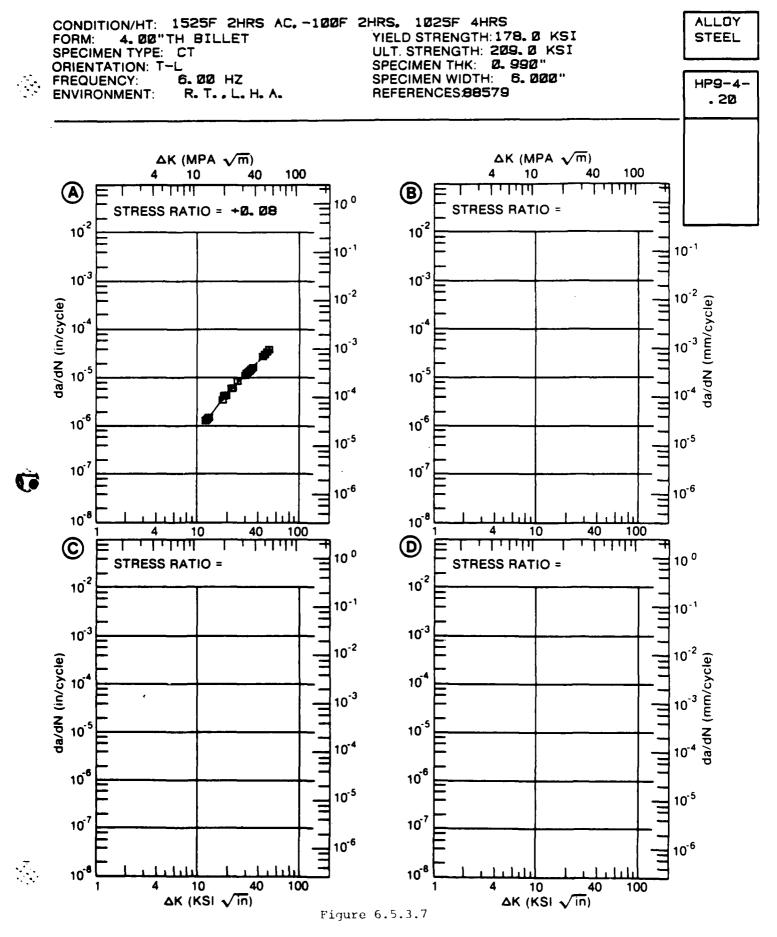### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. L.H.A. SP. THK. =.260"	E= R.T. L.H.A. SP. THK. =.504"		
A: 8.16	:	.393			
DELTA K B: 9.68	:		.531		
MIN C:	:				
D:	:				
9.00	:	.477			
10.00	:	.688	.574		
13.00	:	1.60	1.64		
16.00	:	2.84	3.24		
20.00	:	4.88	5.85		
25.00	:	7.76	9.61		
30.00	:	10.9	13.9		
35.00	:	14.6	19.1		
40.00	:	19.1	25.4		
50.00	:	30.6	37.4		
60.00	:	44.8			
A: 68.23	:	57.6			
DELTA K B: 53.22	:		39.4		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	2.81	14.12		

LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH:186.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 211.0 KSI
ORIENTATION L-T   SPECIMEN THK:
STRESS RATIO: +0.08   SPECIMEN WIDTH: 6.000"
FREQUENCY: 6.00 HZ   REFERENCES:88579, 85837

Figure 6.5.3.16

TABLE 6.5.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=- 65F L.H.A.	E= R.T. L.H.A.	E= R.T. S.C.S.	E= R.T. S.T.W.
DELTA K MIN	A: 14.63	1.45			
	B: 12.61		1.35		
	C: 5.66			.101	
	D: 5.62				.144
	6.00			.123	.172
	7.00			.195	.265
	8.00			.288	.388
	9.00			.416	.546
	10.00			.596	.742
	13.00		1.49	1.53	1.59
	16.00	2.05	2.77	2.97	2.87
	20.00		4.96	5.44	5.26
	25.00		8.32	8.98	9.23
	30.00		12.6	12.6	14.0
	35.00		18.4	16.0	19.2
	40.00		26.5	19.0	24.4
	50.00		40.9		
DELTA K MAX	A: 18.90	2.64			
	B: 55.93		41.2		
	C: 41.08			19.6	
	D: 43.29				27.8
ROOT MEAN SQUARE PERCENT ERROR		12.87	13.81	13.85	6.38

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	1
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH:186.0- 189.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 203.0- 211.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.989- 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 6.000"
FREQUENCY: 1.00 HZ   REFERENCES:85837, 88579

Figure 6.5.3.17

6.5-47

TABLE 6.5.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
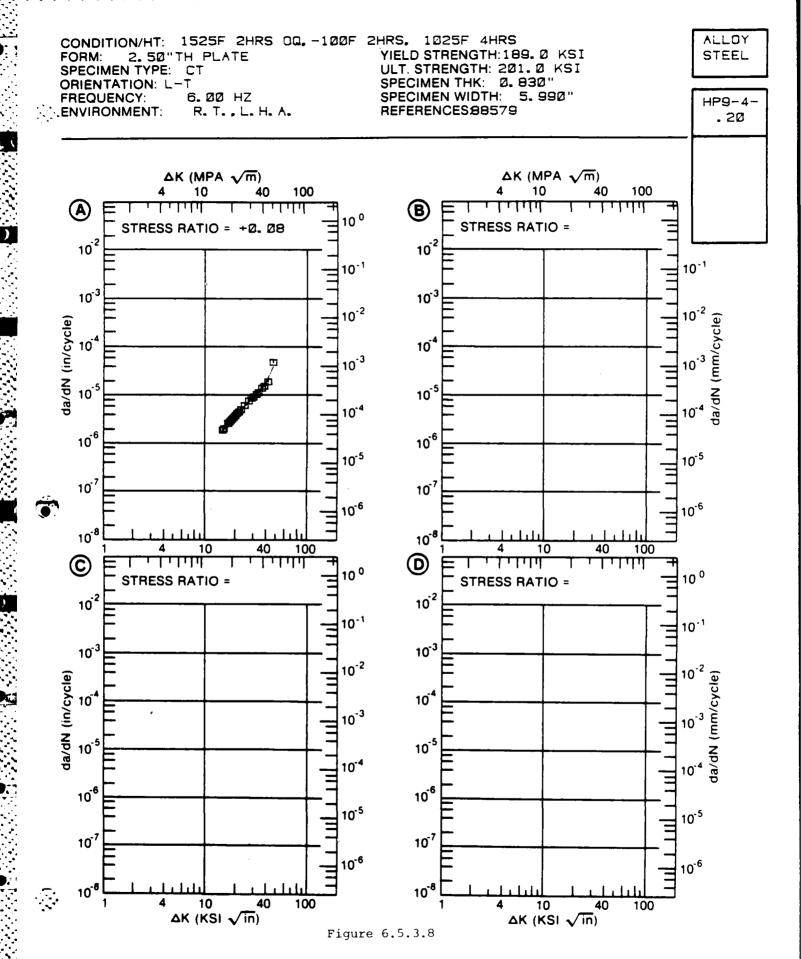
DATA ASSOCIATED WITH FIGURE 6.5.3.18 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.10	F(HZ)= 9.00		
DELTA K MIN	A: 10.61	.828			
	B: 3.86		.0801		
	C:				
	D:				
	4.00		.0851		
	5.00		.131		
	6.00		.199		
	7.00		.293		
	8.00		.418		
	9.00		.578		
	10.00		.779		
	13.00	1.54	1.67		
	16.00	2.74	3.06		
	20.00	4.58	5.77		
	25.00	7.19	10.5		
	30.00	10.3	16.5		
	35.00	14.3	23.4		
	40.00	19.4	30.6		
	50.00	34.3			
DELTA K MAX	A: 58.49	49.8			
	B: 43.08		35.1		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	2.77	5.07		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
0.0-0.5				
0.5-0.8				
0.8-1.25	1	1		
1.25-2.0				
>2.0				
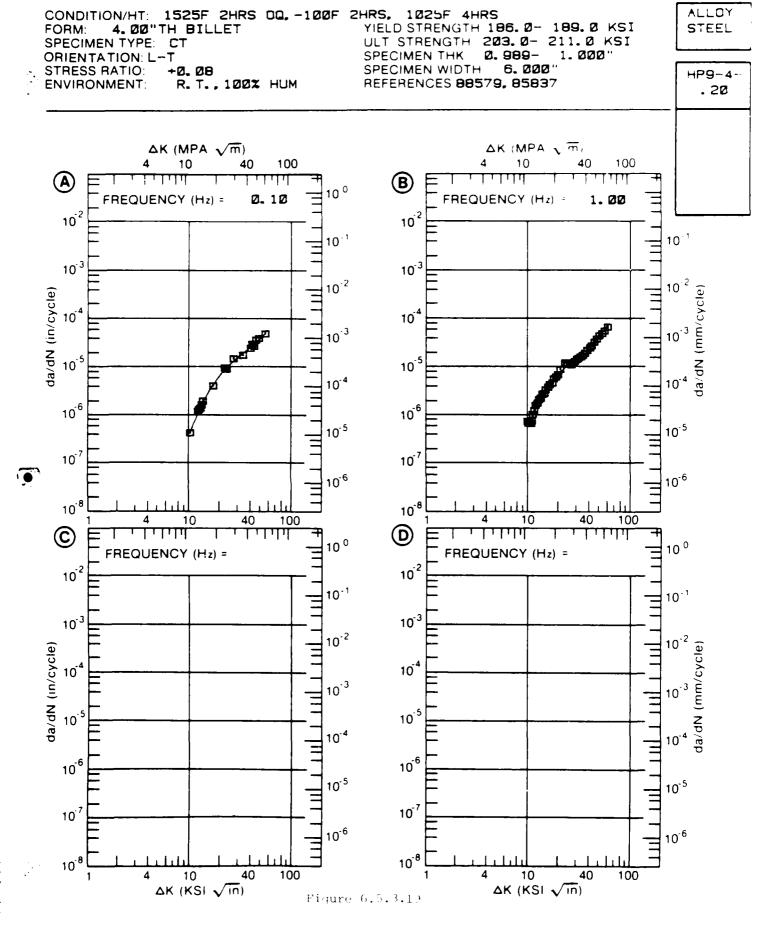
CONDITION/HT: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH: 186.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 211.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 6.000"
ENVIRONMENT: R.T., L.H.A.   REFERENCES: 88579

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.13

6.5-49

TABLE 6.5.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.19 INDICATING EFFECT

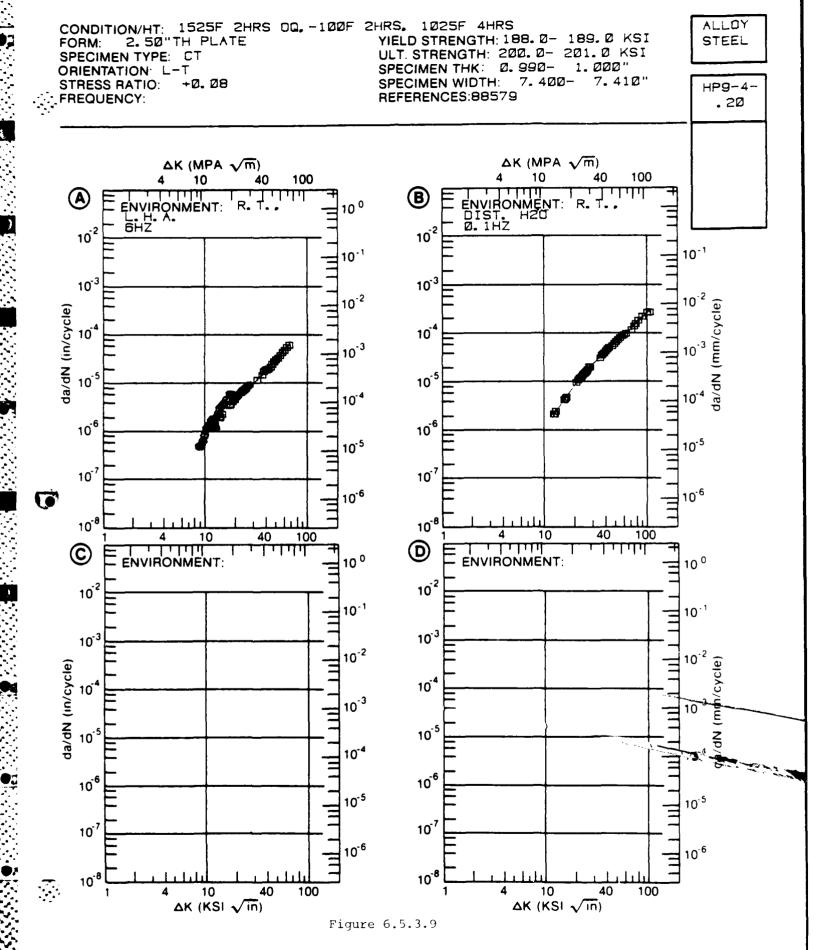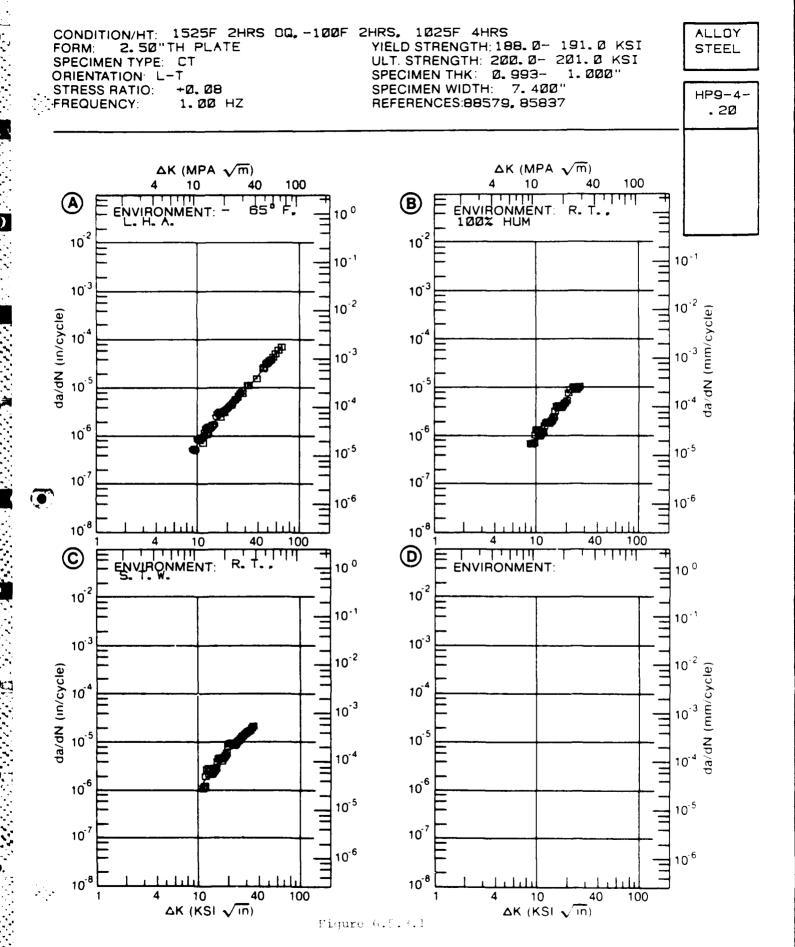### OF FREQUENCY

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,100% HUM
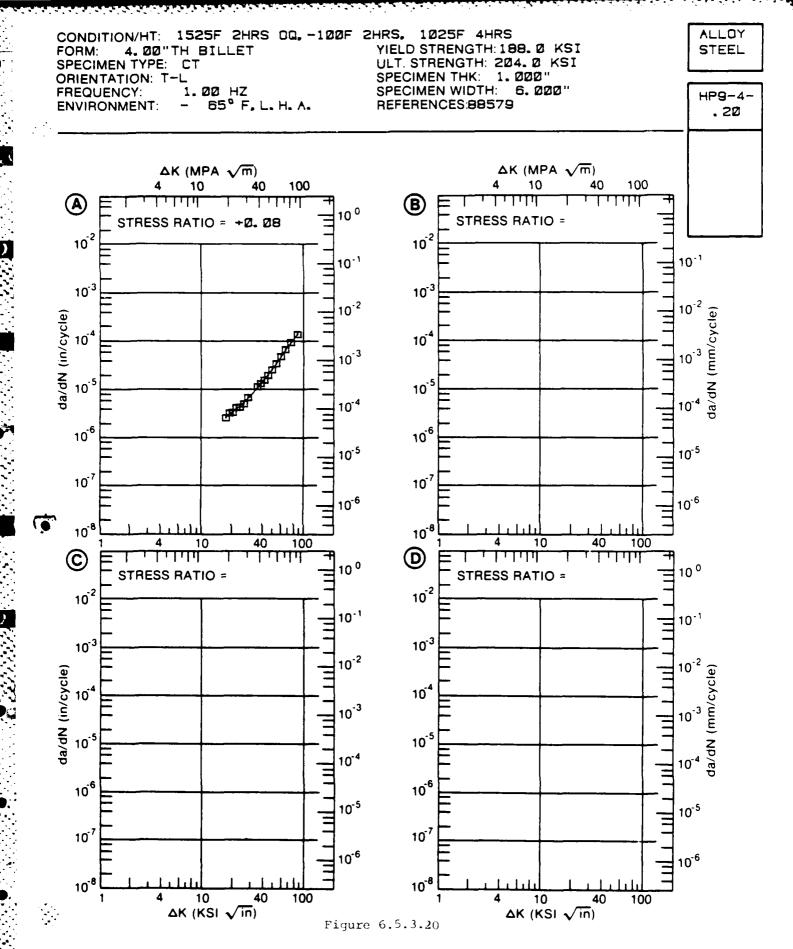
DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.10	F(HZ)= 1.00		
A:	10.13	.423			
DELTA K B:	9.79		.555		
MIN C:					
D:					
	10.00		.623		
	13.00	1.54	2.09		
	16.00	3.44	4.22		
	20.00	6.63	7.39		
	25.00	11.0	11.2		
	30.00	15.4	14.9		
	35.00	20.1	18.9		
	40.00	25.2	24.1		
	50.00	38.5	40.6		
A:	55.79	49.0			
DELTA K B:	59.72		72.6		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		6.79	10.69		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH 186.0- 189.0 KSI
SPECIMEN TYPE: CT   ULT STRENGTH 203.0- 211.0 KSI
ORIENTATION: L-T   SPECIMEN THK   0.989- 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH   6.000"
ENVIRONMENT: R. T., 100% HUM   REFERENCES 88579. 85837

ALLOY
STEEL

HP9-4-
.20

Figure 6.5.3.19

6.5-51

TABLE 6.5.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.20 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ, -100F 2HRS, 1025F 4HRS
ENVIRONMENT: - 65F, L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.08			
DELTA K MIN	A:	17.18	2.64			
	B:					
	C:					
	D:					
		20.00	3.33			
		25.00	4.96			
		30.00	7.27			
		35.00	10.5			
		40.00	14.9			
		50.00	27.8			
		60.00	47.3			
		70.00	74.3			
		80.00	109.			
DELTA K MAX	A:	86.98	138.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	4.77

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET   YIELD STRENGTH:188.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 204.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 1.000"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 6.000"
ENVIRONMENT: - 65° F. L. H. A.   REFERENCES:88579

Figure 6.5.3.20

TABLE 6.5.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.5.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.20
CONDITION: 1525F 2HRS OQ,-100F 2HRS, 1025F 4HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.05			
DELTA K MIN	A:	24.44	2.98			
	B:					
	C:					
	D:					
		25.00	3.70			
		30.00	9.15			
		35.00	13.3			
		40.00	17.9			
		50.00	29.7			
		60.00	47.1			
		70.00	74.0			
		80.00	116.			
		90.00	175.			
DELTA K MAX	A:	97.82	236.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	16.46

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	
	0.5-0.8	
	0.8-1.25	
	1.25-2.0	1
	>2.0	

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 4HRS
FORM: 4.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
FREQUENCY: 1.00 HZ
ENVIRONMENT: R. T., L. H. A.

YIELD STRENGTH: 188.0 KSI
ULT. STRENGTH: 204.0 KSI
SPECIMEN THK: 2.000"
SPECIMEN WIDTH: 5.810"
REFERENCES: 88579

ALLOY
STEEL

HP9-4-
.20

Figure

TABLE 6.5.3.22

ALLOY STEEL   HP9-4-20   K(ISCC)

CONDITION	PRODUCT FORM	TEST SPEC THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN (KSI*SQRT IN)	STAN DEV	TEST TIME (MIN)	DATE	REFER
	P	0.50	R.T	--	----	N2O4-0.2% H2O	5.500	0.500	TDCB	----	130.00	140.00*		----	1971	80667
	P	0.50	R.T	--	----	SYNTH SEAWATER	----	----	TDCB	----	------	110.00*		----	1969	74232
	F	1.25	R.T.	T-L	198.0	SIM. SEA WATER	3.083	1.247	BWOL	1.367	------	92.80		195840	1977	MA005
		1.25			198.0		3.088	1.250	BWOL	1.366	------	94.50	93.7/ 1.2	195840	1977	MA005
GTA WELD WELDMENT	P	0.50	R.T.	---	----	SYNTH SEAWATER	----	----	TDCB	----	------	65.00		----	1969	74232
QUENCHED AND TEMPERED	P	1.00	R.T	--	180.0	3.5 PCT NACL	----	1.000	CANT*	----	210.00	110.00		----	1972	83613
		1.00		--	195.0		----	1.000	CANT*	----	200.00	110.00	110.0/ 0.0	----	1972	83613
1525F 2HRS OQ.	P	2.50	R.T	L-T	189.0	S.T.W.	2.000	1.000	DCB	---	119.00	105.00		86280	1976	R1006
-100F 2HRS,		2.50			189.0		2.000	1.000	DCB	---	119.00	103.00		86280	1976	R1006
1025F 4HRS		2.50			189.0		2.000	1.000	DCB	---	119.00	107.00	105.0/ 2.0	86280	1976	R1006
1525F 2HRS OQ.	P	2.50	R.T.	T-L	170.0	S.T.W.	2.000	1.000	DCB	---	119.00	97.00		86280	1976	R1006
-100F 2HRS,		2.50			190.0		2.000	1.000	DCB	---	119.00	97.00		86280	1976	R1006
1025F 4HRS		2.50			190.0		2.000	1.000	DCB	---	119.00	93.00		86280	1976	R1006
		2.50			190.0		2.000	1.000	DCB	---	119.00	104.00		86280	1976	R1006
		2.50			190.0		2.000	1.000	DCB	---	119.00	96.00	97.4/ 4.0	86280	1976	R1006
1525F 2HRS OQ.	FB	4.00	R.T	L-T	186.0	S.C.S.	2.000	1.000	DCB	---	118.00	>122.00		60660	1976	R1006
-100F 2HRS, 1025F 4HRS		4.00			186.0		2.000	1.000	DCB	---	118.00	>129.00		60180	1976	R1006
1525F 2HRS OQ.	FB	4.00	R.T.	L-T	186.0	S.T.W.	2.000	1.000	DCB	---	118.00	<126.00		86280	1976	R1006
-100F 2HRS,		4.00			184.0		2.000	1.000	DCB	---	118.00	<129.00		86280	1976	R1006
1025F 4HRS		4.00			186.0		2.000	1.000	DCB	---	118.00	110.00		86280	1976	R1006
1525F 2HRS OQ. FB -100F 2HRS, 1025F 4HRS	FB	4.00	R.T.	T-L	187.0	S.T.W.	2.000	1.000	DCB	---	118.00	109.00		86280	1976	R1006

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.4.3.22 (Con't)

ALLOY STEEL   HP9-4-20   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (#=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1525F 2HRS OQ, FB -100F 2HRS, 1025F 4HRS	FB	4 00	R T	T-L	187.0	S.T.W.	2.000	1.000	DCB	----	118.00	105.00			76860	1976	R1006
		4 00			187 0		2.000	1.000	DCB	----	118.00	117.00	107.0/	2.8	86280	1976	R1006
1525F 2HRS OQ, FB -100F 2HRS, 1025F 4HRS	FB	4 00	R T	S-T	----	S.T.W.	2.000	1.000	DCB	----	118.00	97.00			86280	1976	R1006
		4 00			----		2.000	1.000	DCB	----	118.00	79.00			86280	1976	R1006
		4 00			----		2.000	1.000	DCB	----	118.00	81.00			86280	1976	R1006
					----		2.000	1.000	DCB	----	118.00	75.00	78.3/	3.1	116820	1976	R1006

TABLE 6.6.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
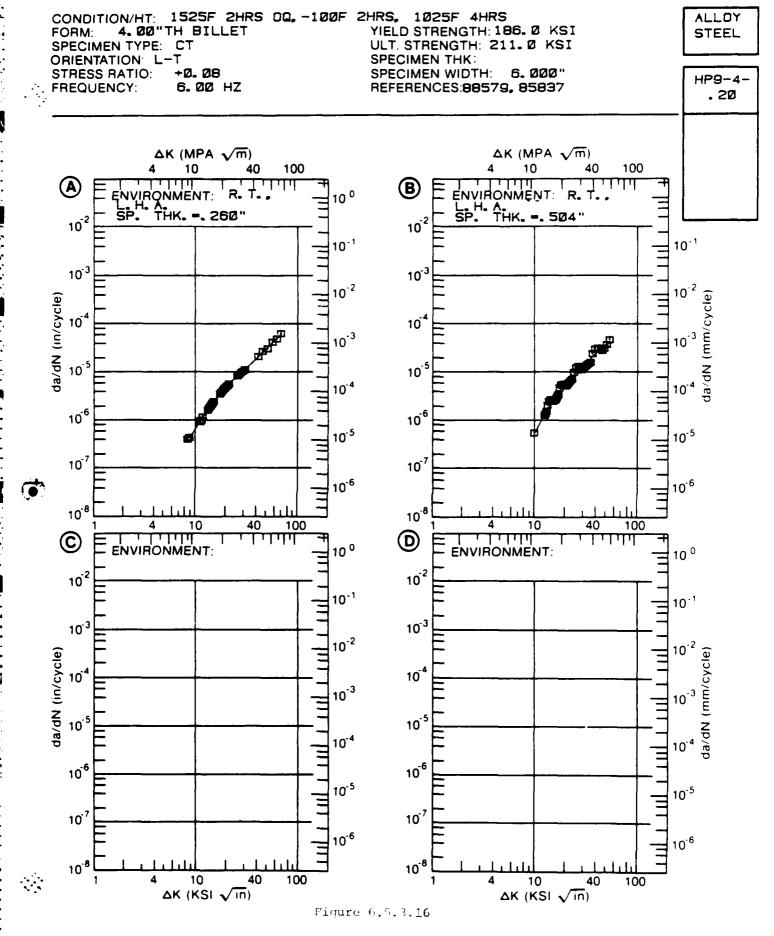
DATA ASSOCIATED WITH FIGURE 6.6.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20(CEVM)
CONDITION: ANNEALED

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. LAB AIR 5-10HZ	E= R.T. SIM. SEA WATER 1-20HZ		
DELTA K MIN	A:	10.59	1.04			
	B:	11.52		1.04		
	C:					
	D:					
		13.00	2.03	1.59		
		16.00	3.62	3.03		
		20.00	6.19	5.56		
		25.00	9.93	9.51		
		30.00	14.2	14.2		
		35.00	18.9	19.6		
		40.00	24.2	25.8		
		50.00	37.0	40.7		
		60.00	53.7	59.8		
		70.00	75.6			
		80.00	104.			
DELTA K MAX	A:	89.69	141.			
	B:	63.26		67.1		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			7.22	9.60		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5					
	0.5-0.8					
	0.8-1.25		2	2		
	1.25-2.0					
	>2.0					

CONDITION/HT: ANNEALED
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION· L-T
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 191.8 KSI
ULT. STRENGTH: 204.2 KSI
SPECIMEN THK: 0.997-   1.003"
SPECIMEN WIDTH: 7.400"
REFERENCES:NC002

ALLOY
STEEL

HP9-4-
20 (CEVM)

Figure 6.6.3.1

TABLE 6.6.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
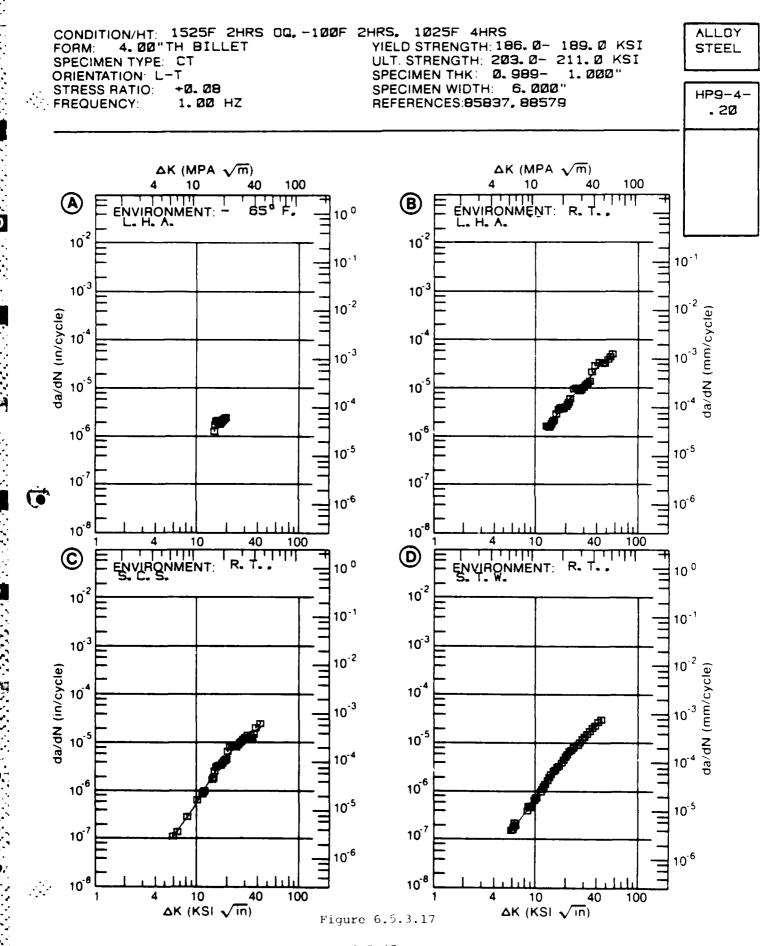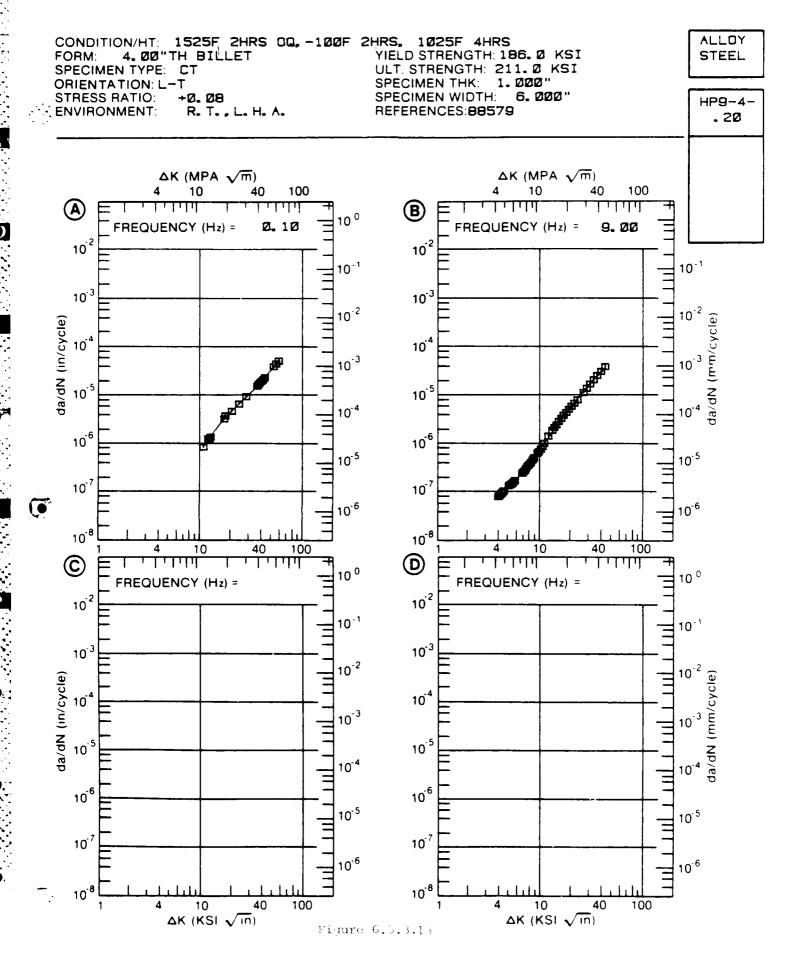
DATA ASSOCIATED WITH FIGURE 6.6.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.20(CEVM)
CONDITION: ANNEALED

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. LAB AIR 10-15HZ	E= R.T. SIM. SEA WATER 1-10HZ		
DELTA K MIN A: 10.03	:	.928			
DELTA K MIN B: 11.55	:		1.16		
MIN C:	:				
D:	:				
13.00	:	2.17	1.73		
16.00	:	3.84	3.22		
20.00	:	6.53	5.78		
25.00	:	10.5	9.77		
30.00	:	15.1	14.6		
35.00	:	20.5	20.2		
40.00	:	26.7	26.8		
50.00	:	42.9	43.6		
60.00	:	65.7	66.6		
70.00	:	98.1			
80.00	:	144.			
DELTA K MAX A: 87.05	:	188.			
DELTA K MAX B: 65.98	:		84.3		
MAX C:	:				
D:	:				
ROOT MEAN SQUARE PERCENT ERROR		8.76	8.20		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	2	2	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: ANNEALED
FORM: 3.00"TH FORGING
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY:

YIELD STRENGTH: 192.2 KSI
ULT. STRENGTH: 204.8 KSI
SPECIMEN THK: 1.003- 1.004"
SPECIMEN WIDTH: 7.400"
REFERENCES: NC002

A — ENVIRONMENT: R.T., LAB AIR 10-15HZ

B — ENVIRONMENT R.T., SIM. SEA WATER 1-10HZ

C — ENVIRONMENT:

D — ENVIRONMENT:

Figure 6.6.3.2
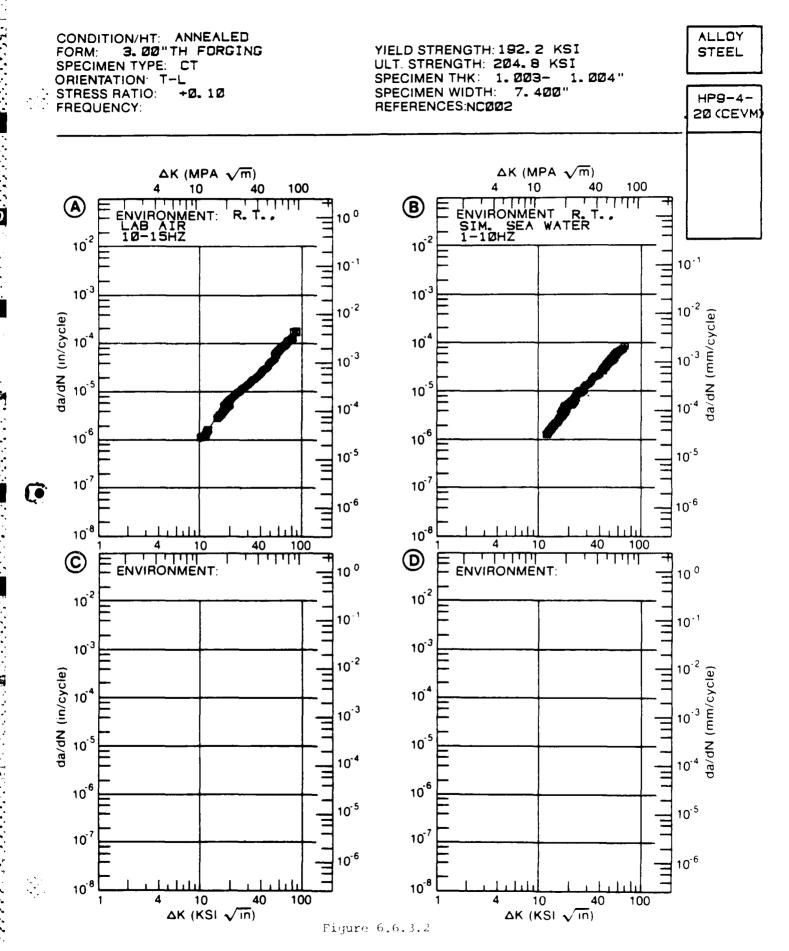
TABLE 6.7.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HP 9-4-25(VAR) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		

FORGING

CONDITION/HT	L-T	T-L	S-L
1550F 1 HR. OQ 1000F 2+2HR. AC	----	98.9 ± 4.5 (2)	----

TABLE 6.7.2.1

ALLOY STEEL   HP 9-4- 25(VAR) K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1550F 1 HR.OQ	F	3.00	-75	T-L	187.0	5.110	2.000	WOL	1.834	1.08	123.00		196	76411 (1)
1000F 2+2HR.AC	F	3.00			187.0	5.110	2.000	WOL	1.864	0.82	107.00	115.0/ 11.3	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	-40	T-L	188.0	5.110	2.000	WOL	1.886	0.86	110.00		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			188.0	5.110	2.000	WOL	1.863	0.89	112.00	111.0/ 1.4	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	0	T-L	187.0	5.110	2.000	WOL	1.837	0.82	107.00		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			187.0	5.110	2.000	WOL	1.879	0.79	105.00	106.0/ 1.4	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	32	T-L	187.0	5.110	2.000	WOL	1.868	0.79	104.00		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			187.0	5.110	2.000	WOL	1.954	0.71	97.40	101.7/ 3.3	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	R.T.	T-L	175.0	5.110	2.000	WOL	1.822	0.75	95.70		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			175.0	5.110	2.000	WOL	1.808	0.85	102.00	98.9/ 4.5	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	100	T-L	180.0	5.110	2.000	WOL	1.853	0.84	104.00		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			180.0	5.110	2.000	WOL	1.855	0.78	101.00	102.5/ 2.1	1966	76411 (1)
1550F 1 HR.OQ	F	3.00	130	T-L	175.0	5.110	2.000	WOL	1.834	1.00	111.00		1966	76411 (1)
1000F 2+2HR.AC	F	3.00			175.0	5.110	2.000	WOL	1.824	0.92	106.00	108.5/ 3.5	1966	76411 (1)

NOTES
(1) (VAR)=(VACUUM ARC REMELTED)

TABLE 6.8.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL HP 9-4-.30 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS)		
	L-T	T-L	S-L
PLATE			
CONDITION/HT	L-T	T-L	S-L
HEAT TREATED TO 49 RC HARDNESS	----	82.5 ± 5.0 ( )	----
FORGING			
CONDITION/HT	L-T	T-L	S-L
1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR. 1000F 4HR	106.0 ± 1.4 (2)	89.0 ± 3.0 (3)	----
1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR. 1050F 4HR	----	87.5 ± 0.8 (2)	----
1650F 1-2HR AC 1525F 1-2HR DQ -100F 1-3HR 1025F 4HR	----	93.5 ± 0.7 (2)	----
1650F 2HR AC 1550F 2HR DQ 1000F 2+2HR AC	82.0 ± 0.0 (2)	----	----

TABLE 6.8.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT L H A
AT R T

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) →	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
UTS=220-240KSI	BILLET	-1.00	10.00					3.62	30.0	
UTS 220-240KSI	BILLET	0.00	10.00					3.34	25.9	132
UTS=220-240KSI	BILLET	0.50	10.00				0.94	6.26	49.3	
1525F 2HRS OQ, 100F 2HRS,1025F 2+2HR	FORGED BAR	0.30	6.00					4.51	98.9	
1550F 2HRS OQ, 100F 1HR 1025F 2+2HR	FORGED BAR	0.00	1.00				0.89	5.04		
1550F 2HRS OQ, 100F 1HR 1025F 2+2HR	FORGED BAR	0.30	6.00				1.12	7.35		
1550F 2HRS OQ, 100F 1HR 1025F 2+2HR	FORGED BAR	0.50	6.00				1.17	6.60		

TABLE 6.8.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT LAB AIR
AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2.5	5	10	20	50	100
				FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
- -	FORGING	0.02	5.0-20.0			0.39	2.99	38.9	
	BAH	0.02	1.0					46.4	
	BAR	0.02	10.0				3.59	46.6	

TABLE 6.8.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

ENVIRONMENT 3.5% NACl
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))						FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	11	20	50	100						
----	BAR	0.02	1.0					42.8							
TUS=220-240KSI	BILLET	0.00	0.10				6.21	36.3	260						
TUS=220-240KSI	BILLET	0.05	1.00				4.25	41.1							
TUS=220-240KSI	BILLET	0.00	10.00				2.74	27.7	266						
UTS=220-240KSI	BILLET	-1.00	0.10				2.88	33.9							

TABLE 6.8.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT STW AT R.T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2.5	5	10	20	50	100
1525F 2HRS OQ, -100F 1HR. 1025F 2+2HR	FORGED BAR	0.08	1.00				5.68	62.3	
1550F 2HRS OQ, -100F 1HR. 1025F 2+2HR	FORGED BAR	0.08	0.10			3.00	13.2		
1550F 2HRS OQ, -100F 1HR. 1025F 2+2HR	FORGED BAR	0.30	1.00			1.06	7.45		
1550F 2HRS OQ, -100F 1HR. 1025F 2+2HR	FORGED BAR	0.50	1.00			2.38	9.51		
1550F 2HRS OQ, -100F 1HR. 1025F 2+2HR	FORGED BAR	0.50	1.00			1.35	7.70		

FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)

TABLE 6.8.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT ALT IMMERSION IN SEA WATER AT R T

<u>TEST CONDITIONS</u>

SPECIMEN
ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (Hz)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
TUS=220-240KSI	BILLET	0.00	1.00	IMMERSED				4.16	34.3	
TUS=220-240KSI	BILLET	0.00	10.00	IMMERSED				3.51	30.7	
TUS=220-240KSI	BILLET	0.00	1.00	1ST HALF DRY CYCLE				1.62	29.7	
TUS=220-240KSI	BILLET	0.00	10.00	1ST HALF DRY CYCLE				3.28		
TUS=220-240KSI	BILLET	0.00	1.00	2ND HALF DRY CYCLE				2.70	25.8	
TUS 220-240KSI	BILLET	0.00	10.00	2ND HALF DRY CYCLE				3.27		

TABLE 6.8.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT: DRY AIR AT RT

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) 2 5	5	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE) 10	20	50	100
-----	PLATE	0.50	0.10				7.16		
	PLATE	0.80	1.00			14.7			

TABLE 6.8.1.8

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-.30

TEST CONDITIONS

SPECIMEN
ORIENTATION   T-L

ENVIRONMENT   L H A
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))			FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)			
				2 5	5	10	20	50	100	
1550F 2HRS OQ, -100F 1HR 1025F 2+2HR	FORGED BAR	0.08	6.00				5.13			
1550F 2HRS OQ, -100F 2HRS, 1000F 2+2HRS	FORGED BAR	0.08	6.00				3.58	46.7		

TABLE 6.8.1.9

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT: H2O SATURATED JP4 FUEL AT R T

TEST CONDITIONS

SPECIMEN ORIENTATION T-L

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
					2.5	5	10	20	50	100
-----	PLATE	0.00	15.00							
	PLATE	0.10	0.10					2.49		
	PLATE	0.10	1.00						67.7	
	PLATE	0.50	0.10					8.46	49.2	
	PLATE	0.50	1.00					7.88		

TABLE 6.8.1.10

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

TEST CONDITIONS

SPECIMEN
ORIENTATION   T-L

ENVIRONMENT   DIST WATER
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))							FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)
				2	5	5	10	20	50	100	
-----	PLATE	0.00	15.00					2.86			
	PLATE	0.10	0.10						336		
	PLATE	0.10	1.00						51.7		
	PLATE	0.50	1.00					24.0			

TABLE 6.8.1.11

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4-30

ENVIRONMENT 3.5% NACL
                      AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION 1-L

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
-----	PLATE	0.00	15.00					3.02		
	PLATE	0.10	0.10						114	
	PLATE	0.10	1.00						53.6	
	PLATE	0.50	0.10					18.7		
	PLATE	0.50	1.00					11.3		
	PLATE	0.60	0.10				713	293		

TABLE 6.8.1.12

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HP9-4- 30

ENVIRONMENT   S T W
AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION   T-L

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				DELTA K LEVELS (KSI SQRT(IN)) 2 5	5	10	20	50	100
----	PLATE	0.10	0.10					208	
	PLATE	0.10	1.00						67.0
	PLATE	0.50	1.00				9.57		
1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR	FORGED BAR	0.08	1.00			0.68	4.84		

TABLE 6.8.2.1

ALLOY STEEL   HP 9-4-.30   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
-----------	F	1.25	81	L-T	207.5	2.529	1.245	CT	1.273	0.65	106.10	107.1/	1.5	1977	MA005
		1.25	81		207.5	2.519	1.245	CT	1.263	0.67	108.19			1977	MA005
-----------	F	1.25	81	T-L	208.3	2.523	1.246	CT	1.258	0.58	101.10	101.1/	0.0	1977	MA005
		1.25	81		208.3	2.534	1.246	CT	1.293	0.58	101.10			1977	MA005
HEAT TREATED TO 49 RC HARDNESS	P	3.25	R.T.	T-L	189.0	2.004	1.005	NB	0.990	0.52	86.00	82.5/	5.0	1971	84029
		3.25	R.T.		189.0	2.534	1.005	NB	1.010	0.44	78.90			1971	84029
1525F,OQ,-100F 3HR,1050F 4HR	F	3.00	-65	T-L	175.0	5.000	1.900	CT	----	1.64	142.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ,-100F 1-3HR, 1000F 4HR	F	3.00	-65	L-T	220.0	3.000	1.000	CT	----	0.23	67.00	66.5/	0.7	1974	90011
		3.00			220.0	3.000	1.000	CT	----	0.22	66.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ,-100F 1-3HR 1025F 4HR	F	3.00	R.T.	L-T	205.0	3.000	1.000	CT	----	0.80	116.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1000F 4HR	F	3.00	R.T.	L-T	206.0	3.000	1.000	CT	----	0.65	105.00	106.0/	1.4	1974	90011
		3.00			206.0	3.000	1.000	CT	----	0.67	107.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR, 1050F 4HR	F	3.00	R.T.	T-L	200.0	3.000	1.000	CT	----	0.47	87.00	87.6/	0.8	1972	84306
		3.00			200.0	3.000	1.000	CT	----	0.48	88.10			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ -100F 1-3HR 1025F 4HR	F	3.00	R.T.	T-L	205.0	3.000	1.000	CT	----	0.51	93.00	93.5/	0.7	1974	90011
		3.00			205.0	3.000	1.000	CT	----	0.52	94.00			1974	90011
1650F 1-2HR AC 1525F 1-2HR OQ,-100F 1-3HR, 1000F 4HR	F	3.00	R.T.	T-L	206.0	3.000	1.000	CT	----	0.43	86.00			1974	90011

TABLE 6.8.2.1 (Con't)

ALLOY STEEL   HP 9-4-30   K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIEN	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
1650F 1-2HR AC, 1525F 1-2HR DQ, -100F 1-3HR, 1000F 4HR	F	3.00	R.T.	T-L	215.0	3.000	1.000	CT	----	0.46	52.00			1974	90011
		3.00			215.0	3.000	1.000	CT	----	0.43	89.00	89.0/	3.0	1974	90011
1650F 2HRS AC, 1550F 2HR DQ, -100F 2HR AC, 1000F 4HR, AC	F	----	R.T.	----	201.8	2.008	0.997	CT	1.024	0.80	114.20			1977	AM002
1650F. 2HR AC, 1550F 2HR DQ, 1000F 2+2HR AC	F	3.25	R.T.	L-T	192.0	4.014	2.016	CT	1.997	0.48	82.00			1974	88136
		3.25			192.0	4.003	2.015	CT	1.933	0.48	82.00	82.0/	0.0	1974	88136
1650F, AC, 1525F 1-2HR, DQ, -100F 1-3HR, 1050F 4HR	F	3.00	R.T.	T-L	197.0	3.000	1.000	CT	----	0.67	102.00			1974	90011

TABLE 6.8.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. H2O SATURATED JP-4 FUEL	E= R.T. DIST. WATER	E= R.T. 3.5% NACL	
DELTA K MIN A: 16.82		1.76			
DELTA K MIN B: 14.06			.486		
DELTA K MIN C: 12.13				.768	
D:					
13.00				.880	
16.00			1.09	1.50	
20.00		2.49	2.86	3.02	
25.00		4.93	5.39	6.14	
30.00		9.01	8.58	10.2	
DELTA K MAX A: 32.11		11.1			
DELTA K MAX B: 32.59			10.9		
DELTA K MAX C: 31.67				11.6	
D:					
ROOT MEAN SQUARE PERCENT ERROR		7.46	16.31	10.25	

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

Figure 6.8.3.1

6.8-17

TABLE 6.8.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:
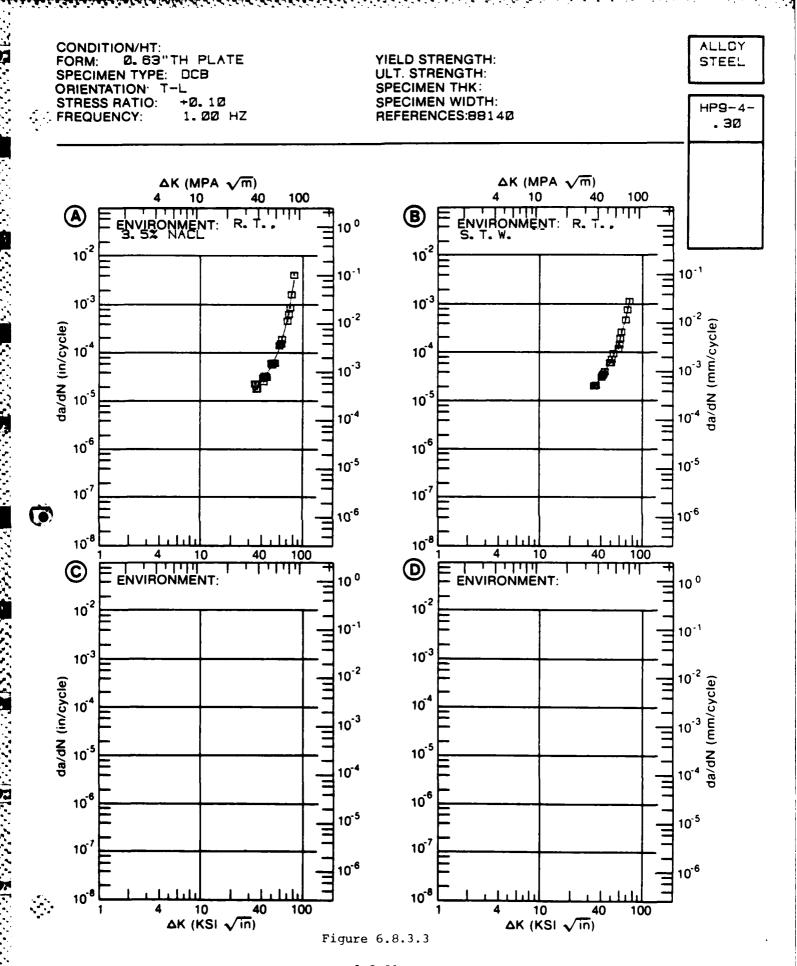
DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. H20 SATURATED JP-4 FUEL	E= R.T. ALT. JP-4 FUEL & DIST. WATER	E= R.T. DIST. WATER	
A:	32.39	17.4			
DELTA K B:	31.49		16.3		
MIN C:	33.22			25.6	
D:					
	35.00	19.8	23.3	25.7	
	40.00	25.5	32.8	28.7	
	50.00	49.2	60.1	51.7	
	60.00	131.	141.	136.	
	70.00	480.	474.	472.	
	80.00		2264.	1984.	
A:	79.89	2259.			
DELTA K B:	82.06		3250.		
MAX C:	81.07			2335.	
D:					
ROOT MEAN SQUARE PERCENT ERROR		15.69	20.13	13.20	

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE   YIELD STRENGTH:
SPECIMEN TYPE: DCB   ULT. STRENGTH:
ORIENTATION: T-L   SPECIMEN THK:
STRESS RATIO: +0.10   SPECIMEN WIDTH:
FREQUENCY: 1.00 HZ   REFERENCES:88140

Figure 6.8.3.2

6.8-19

TABLE 6.8.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. 3.5% NACL	E= R.T. S.T.W.		
DELTA K MIN A:	33.69	16.1			
DELTA K MIN B:	33.79		17.7		
DELTA K MIN C:					
DELTA K MIN D:					
	35.00	18.3	20.1		
	40.00	26.9	31.2		
	50.00	53.6	67.0		
	60.00	135.	171.		
	70.00	478.	574.		
	80.00	2374.			
DELTA K MAX A:	81.70	3215.			
DELTA K MAX B:	74.63		1106.		
DELTA K MAX C:					
DELTA K MAX D:					

ROOT MEAN SQUARE PERCENT ERROR	19.65	8.94		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.3

6.8-21

TABLE 6.8.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T.	E= R.T.	E= R.T.	E= R.T.
	:	H2O SATURATED JP-4 FUEL	DIST. WATER	3.5% NACL	S.T.W.
A: 42.02	:	37.3			
DELTA K B: 32.63	:		172.		
MIN C: 33.47	:			81.3	
D: 32.86	:				74.2
35.00	:		206.	84.1	104.
40.00	:		264.	93.6	165.
50.00	:	67.7	336.	114.	208.
60.00	:	141.	380.	135.	203.
70.00	:	510.	430.	156.	214.
80.00	:	3795.			268.
A: 81.35	:	5261.			
DELTA K B: 74.25	:		459.		
MAX C: 74.38	:			165.	
D: 80.85	:				275.

ROOT MEAN SQUARE PERCENT ERROR	27.30	14.62	6.96	22.52

LIFE   0.0-0.5
PREDICTION   0.5-0.8
  RATIO   0.8-1.25
  SUMMARY   1.25-2.0
  (NP/NA)   >2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.4

6.8-23

TABLE 6.8.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	E= R.T. 3.5% NACL	E= R.T. S.T.W.		
DELTA K MIN A: 17.66	7.08			
B: 17.33		5.32		
C:				
D:				
20.00	11.3	9.57		
25.00	14.4	15.8		
30.00	20.4	24.4		
35.00	51.2	48.1		
40.00	251.	130.		
DELTA K MAX A: 43.14	946.			
B: 43.96		360.		
C:				
D:				
ROOT MEAN SQUARE PERCENT ERROR	15.04	9.73		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.5

TABLE 6.8.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN., CLE)		
		A	B	D
		E= R.T. H2O SATURATED JP-4 FUEL	E= R.T. DIST. WATER	
DELTA K MIN	A: 17.61	5.31		
	B: 17.35		17.0	
	C:			
	D:			
	20.00	7.88	24.0	
	25.00	13.0	31.8	
	30.00	24.3	37.3	
	35.00	63.4	45.6	
	40.00	240.	61.2	
DELTA K MAX	A: 44.83	1210.		
	B: 42.67		74.9	
	C:			
	D:			
ROOT MEAN SQUARE PERCENT ERROR		23.03	12.53	

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.50
FREQUENCY: 1.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.6

6.8-27

TABLE 6.8.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.7 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. DRY AIR	E= R.T. H2O SATURATED JP-4 FUEL	E= R.T. 3.5% NACL	
DELTA K MIN	A: 18.49	4.31			
	B: 19.18		7.07		
	C: 19.21			15.1	
	D:				
	20.00	7.16	8.46	18.7	
	25.00	13.2	15.5	37.6	
	30.00	19.2	25.4	48.0	
	35.00	45.4	57.1	59.1	
	40.00	213.	195.	82.0	
DELTA K MAX	A: 46.29	3988.			
	B: 48.48		4021.		
	C: 45.63			145.	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		33.08	35.71	17.05	

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION· T-L
STRESS RATIO: +0.50
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.7

TABLE 6.8.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.8 INDICATING EFFECT

OF ENVIRONMENT

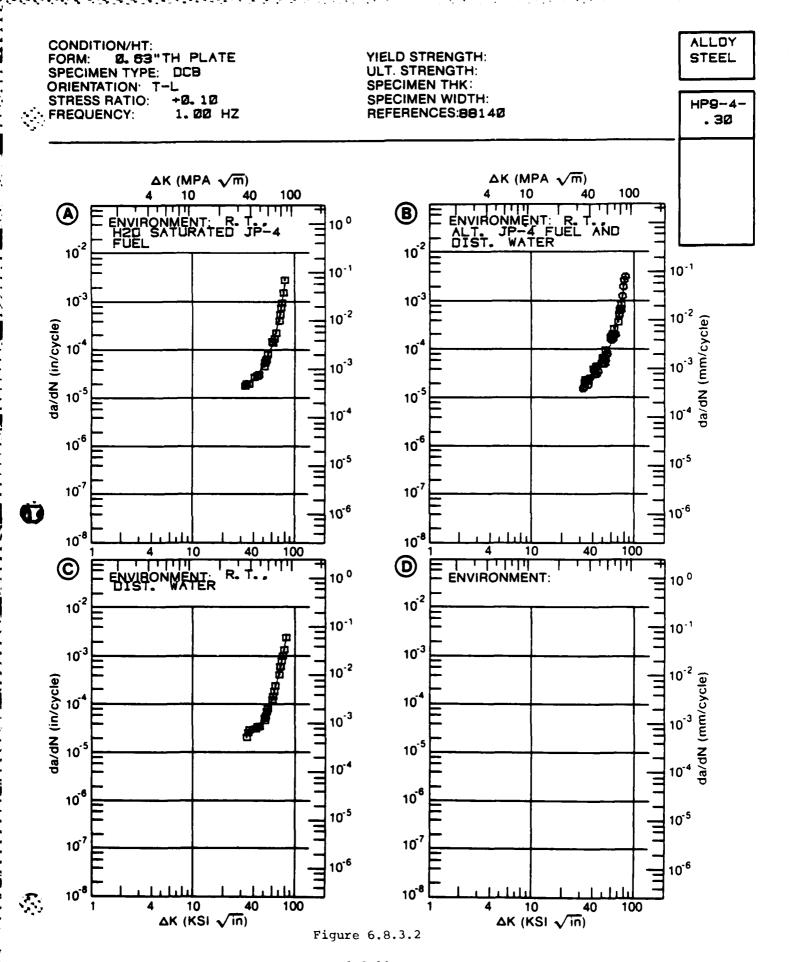
MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)	DA/DN (10**-6 IN./CYCLE)			
	A	B	C	D
	E= R.T. DRY AIR			
DELTA K MIN A: 7.57	5.23			
DELTA K MIN B:				
DELTA K MIN C:				
DELTA K MIN D:				
8.00	8.99			
9.00	12.5			
10.00	14.7			
13.00	35.7			
16.00	320.			
DELTA K MAX A: 16.27	397.			
DELTA K MAX B:				
DELTA K MAX C:				
DELTA K MAX D:				

ROOT MEAN SQUARE   31.55
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB   YIELD STRENGTH:
ORIENTATION: T-L   ULT. STRENGTH:
STRESS RATIO: +0.80   SPECIMEN THK:
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH:
                             REFERENCES:88140

Figure 6.8.3.8

TABLE 6.8.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R. T. 3.5% NACL			
DELTA K MIN	A: 7.53	9.22			
	B:				
	C:				
	D:				
	8.00	15.6			
	9.00	37.7			
	10.00	71.3			
	13.00	201.			
	16.00	287.			
	20.00	293.			
DELTA K MAX	A: 20.05	293.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	23.29

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 0.63"TH PLATE
SPECIMEN TYPE: DCB
ORIENTATION: T-L
STRESS RATIO: +0.80
FREQUENCY: 0.10 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:88140

Figure 6.8.3.9

TABLE 6.8.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.10 INDICATING EFFECT

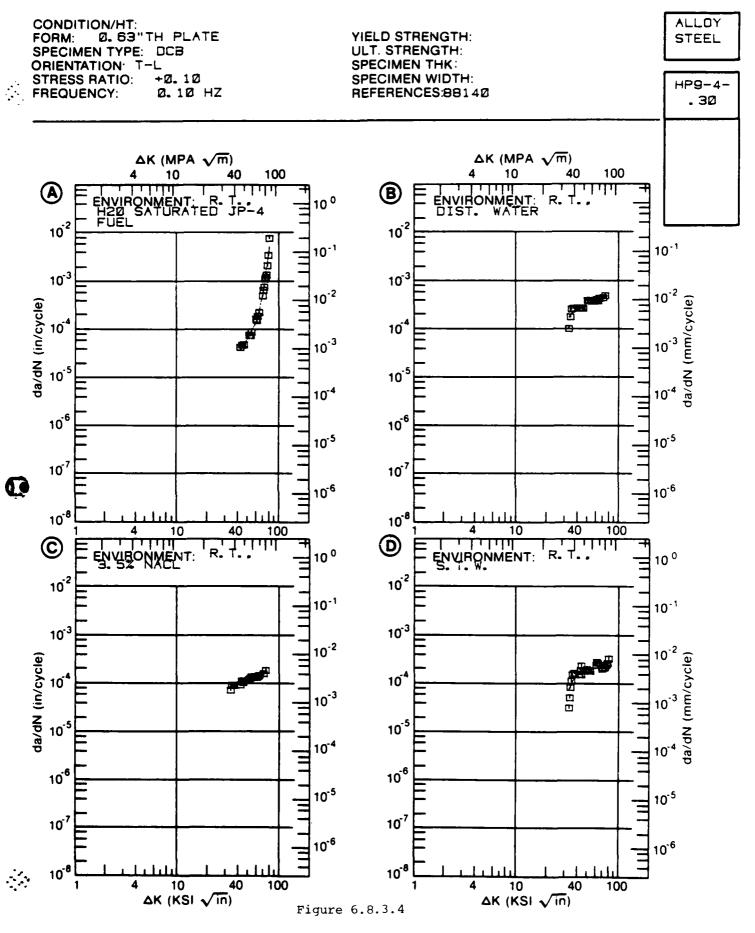### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR 1HZ	E= R.T. LAB AIR 10HZ	E= R.T. 3.5% NACL 1HZ	
DELTA K MIN	A: 21.66	6.29			
	B: 12.31		.880		
	C: 21.78			5.82	
	D:				
	13.00		1.05		
	16.00		1.96		
	20.00		3.59		
	25.00	7.96	6.34	7.60	
	30.00	11.6	10.1	11.3	
	35.00	17.0	15.4	16.3	
	40.00	24.4	22.6	22.9	
	50.00	46.4	46.6	42.8	
	60.00	79.8			
	70.00	126.			
DELTA K MAX	A: 75.97	159.			
	B: 56.90		75.0		
	C: 55.81			59.4	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		2.86	3.82	2.80	

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1	1	
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT:
FORM: 2.50"TH BAR
SPECIMEN TYPE: CT
ORIENTATION L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH:192.5 KSI
ULT. STRENGTH: 228.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:88136
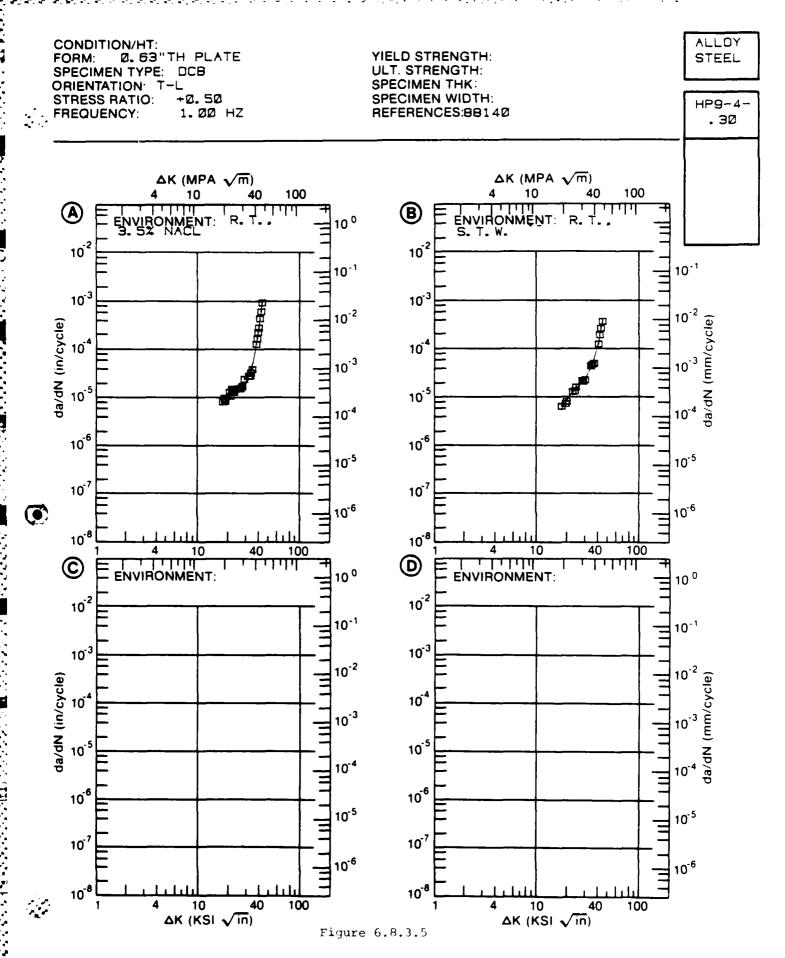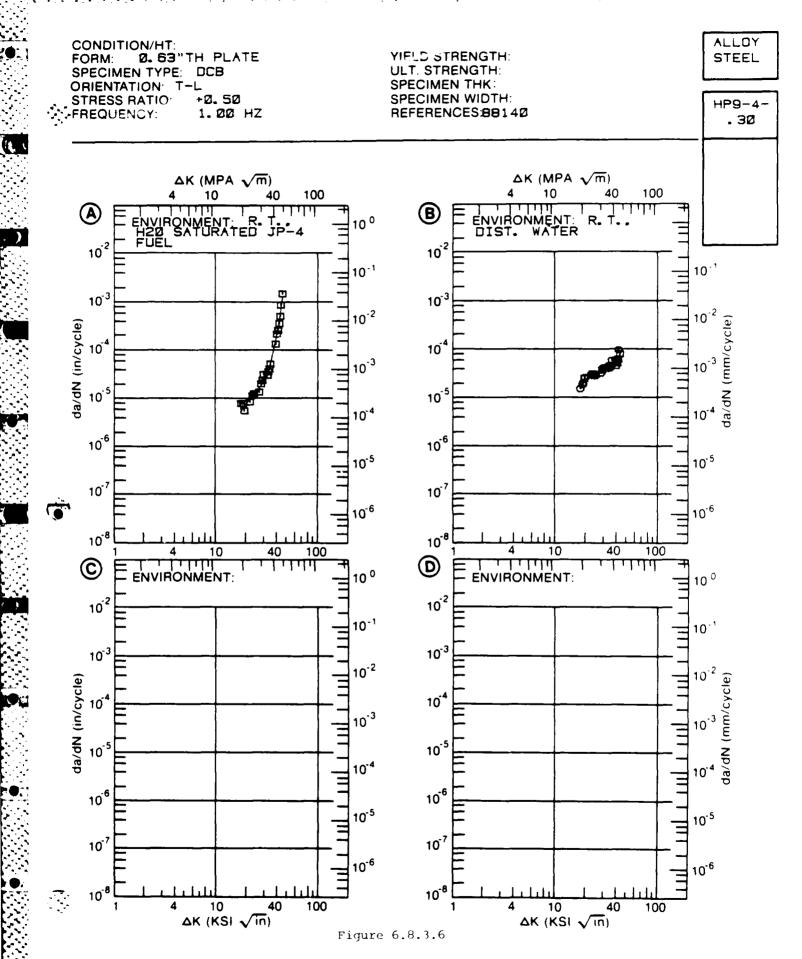
ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.10

TABLE 6.8.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
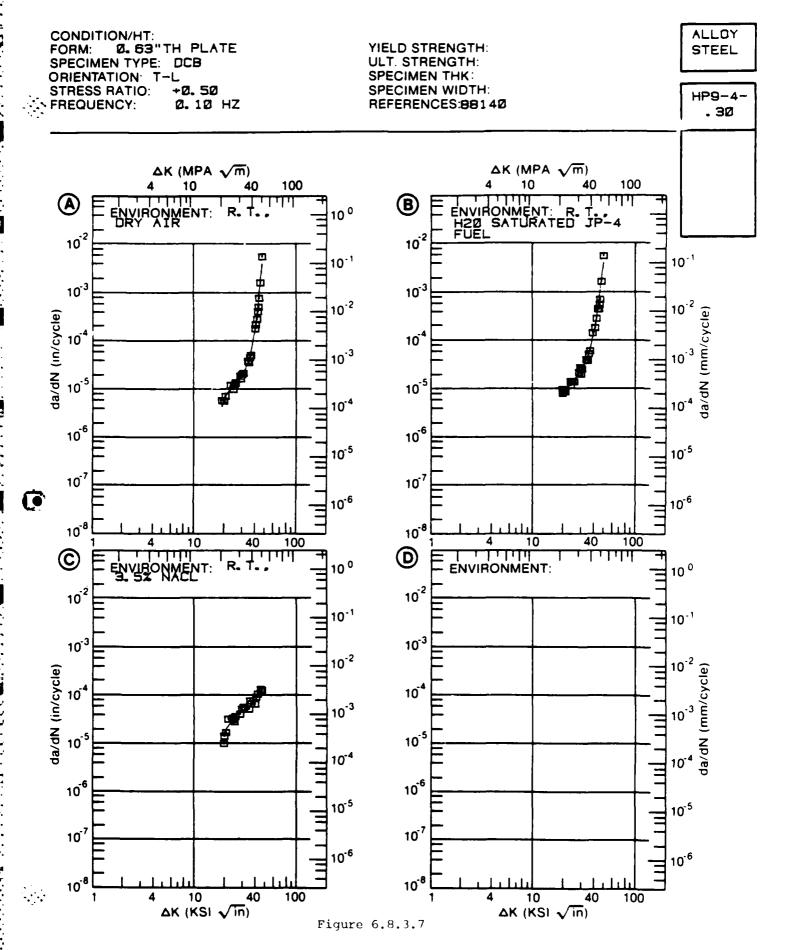
DATA ASSOCIATED WITH FIGURE 6.8.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR 5-20HZ	E= R.T. SIM SEA WATER .1-15HZ		
DELTA K MIN	A: 6.38	.110			
	B: 20.13		1.96		
	C:				
	D:				
	7.00	.138			
	8.00	.200			
	9.00	.286			
	10.00	.399			
	13.00	.901			
	16.00	1.63			
	20.00	2.99			
	25.00	5.40	5.37		
	30.00	8.83	9.86		
	35.00	13.6	15.3		
	40.00	20.0	21.6		
	50.00	38.9	37.3		
	60.00	63.8	58.7		
	70.00	89.2	89.4		
	80.00		135.		
	90.00		203.		
	100.00		306.		
	130.00		961.		
DELTA K MAX	A: 71.24	92.1			
	B: 139.67		1271.		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	18.91	16.17

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION· L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH:204.5 KSI
ULT. STRENGTH: 230.5 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:MA005

A — ENVIRONMENT: R.T., LAB AIR 5-20HZ

B — ENVIRONMENT: R.T., SIM SEA WATER .1-15HZ

C — ENVIRONMENT:

D — ENVIRONMENT:

Figure 6.8.3.11

TABLE 6.8.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.12 INDICATING EFFECT

OF ENVIRONMENT

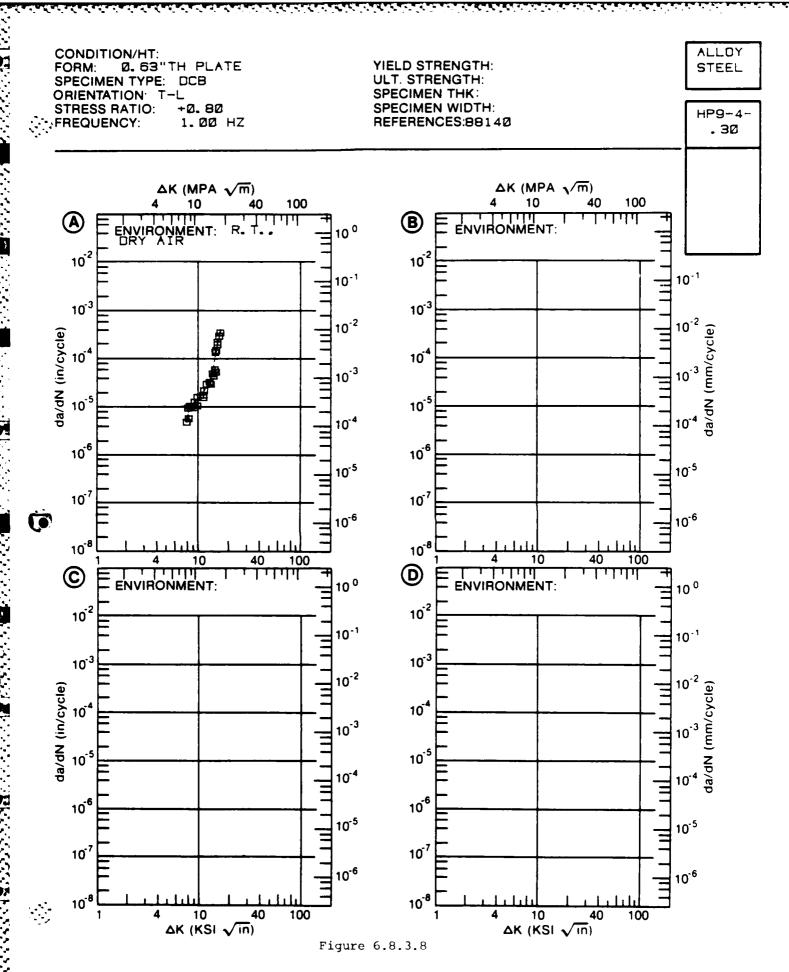MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR .1-20HZ	E= R.T. SIM SEA WATER .1-15HZ		
DELTA K MIN	A: 7.13	.181			
	B: 15.09		.791		
	C:				
	D:				
	8.00	.208			
	9.00	.282			
	10.00	.399			
	13.00	.979			
	16.00	1.82	.994		
	20.00	3.34	2.45		
	25.00	5.97	5.44		
	30.00	9.65	9.38		
	35.00	14.8	14.4		
	40.00	21.9	20.9		
	50.00	45.8	41.6		
	60.00	95.5	82.3		
	70.00	205.	166.		
	80.00	458.	345.		
	90.00	996.	732.		
	100.00	1883.	1867.		
DELTA K MAX	A: 111.38	3048.			
	B: 110.08		9836.		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		20.12	19.19		

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25		
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION: T-L
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 206.0 KSI
ULT. STRENGTH: 233.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES: MA005
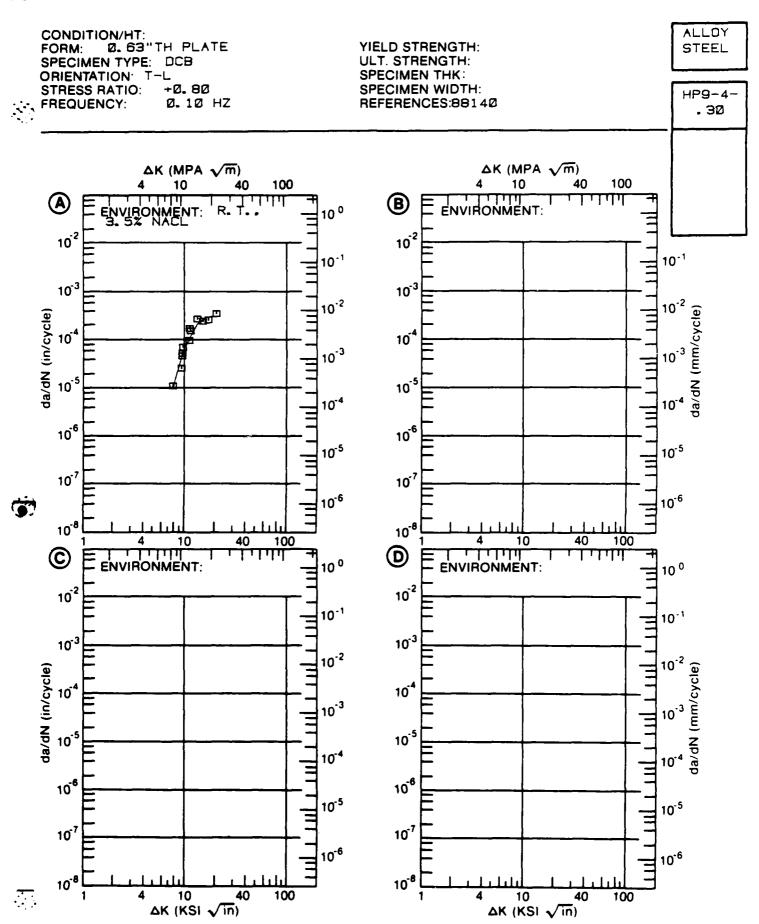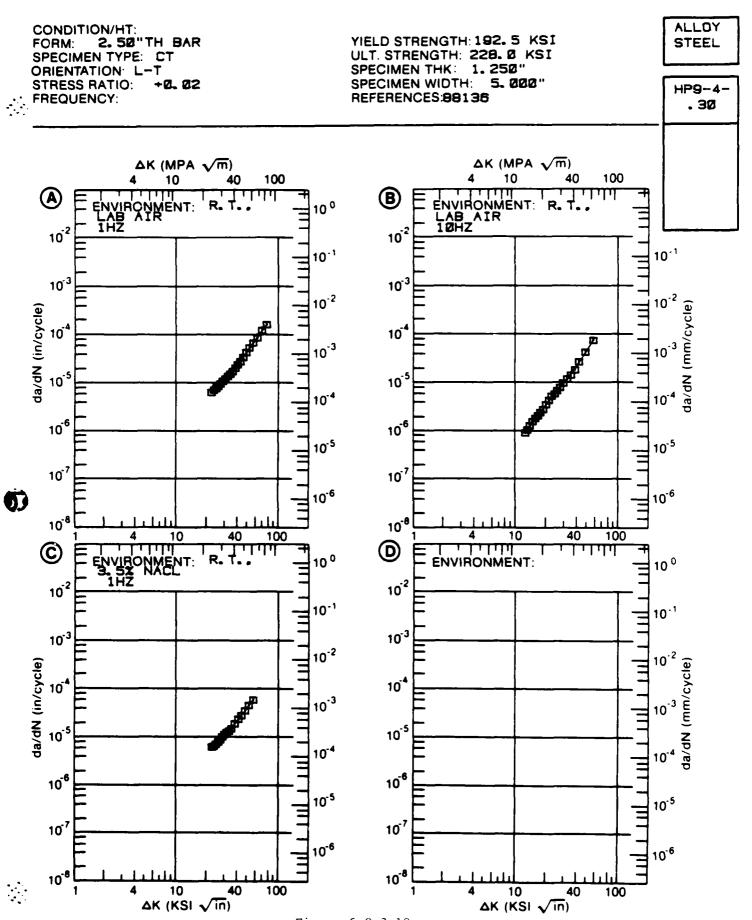
ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.12

TABLE 6.8.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
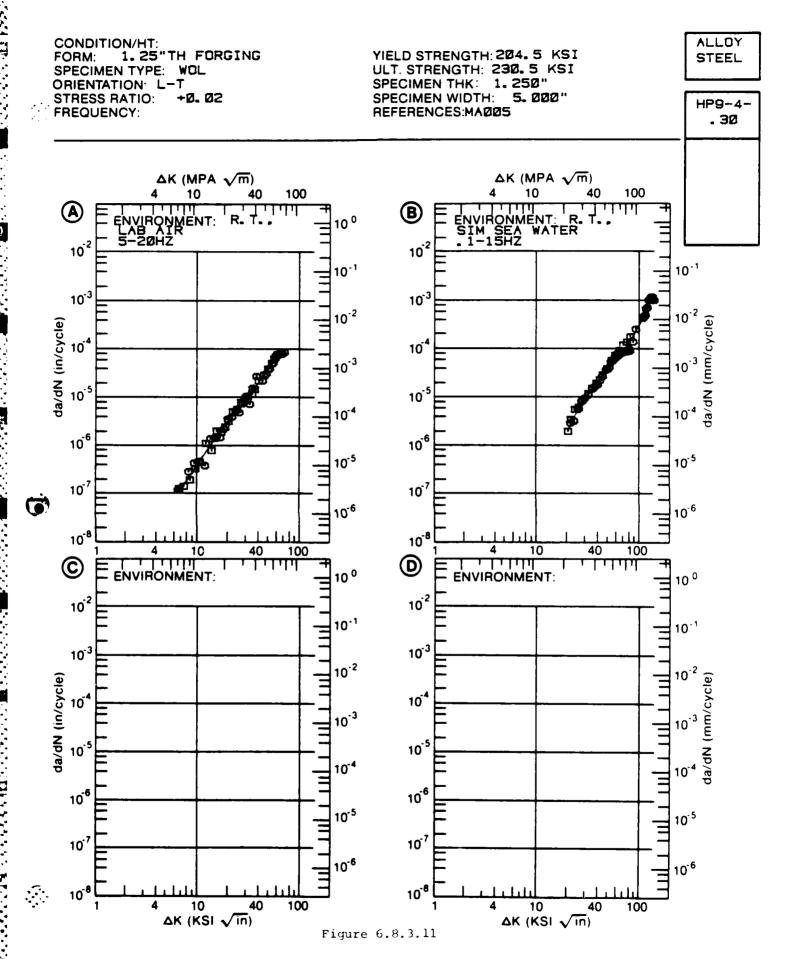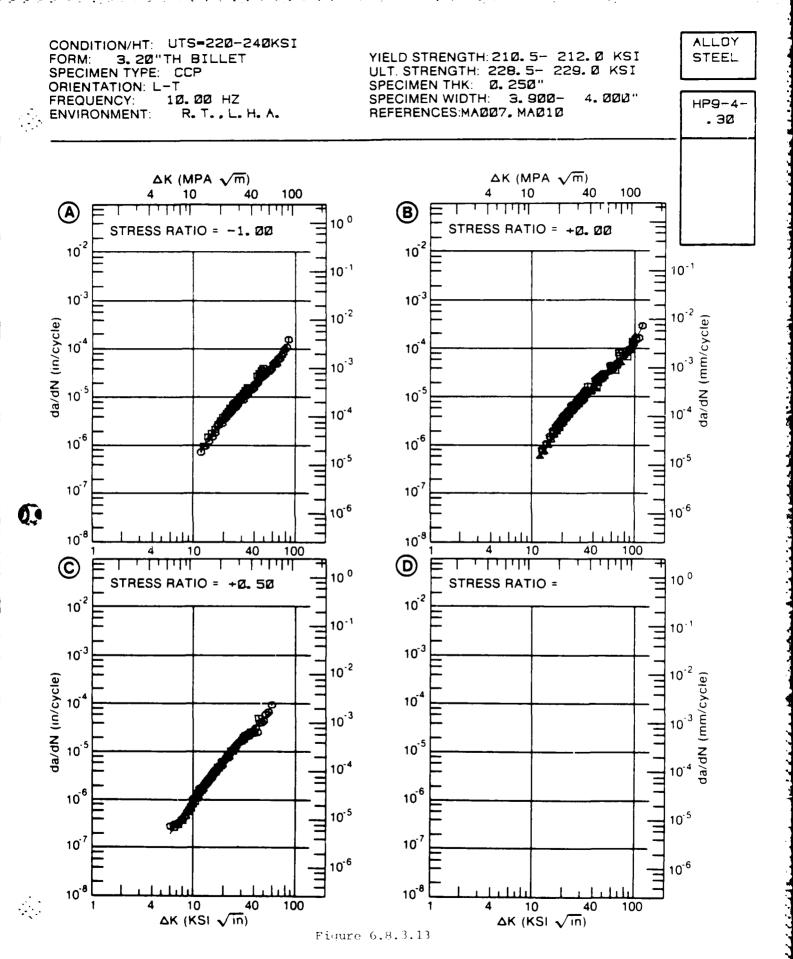
DATA ASSOCIATED WITH FIGURE 6.8.3.13 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=-1.00	R=+0.00	R=+0.50	
DELTA K MIN	A:	11.76	.708			
	B:	11.75		.562		
	C:	5.78			.191	
	D:					
		6.00			.213	
		7.00			.336	
		8.00			.497	
		9.00			.700	
		10.00			.948	
		13.00	1.01	.835	1.98	
		16.00	1.94	1.72	3.49	
		20.00	3.62	3.34	6.26	
		25.00	6.31	5.92	10.9	
		30.00	9.64	8.99	16.8	
		35.00	13.6	12.5	23.8	
		40.00	18.4	16.5	31.6	
		50.00	30.0	25.9	49.3	
		60.00	43.0	37.9		
		70.00	61.4	53.4		
		80.00	99.2	73.2		
		90.00		98.8		
		100.00		132.		
DELTA K MAX	A:	85.73	141.			
	B:	118.22		283.		
	C:	58.56			65.7	
	D:					

ROOT MEAN SQUARE PERCENT ERROR	11.42	13.18	10.66

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT: UTS-220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T.,L.H.A.

YIELD STRENGTH: 210.5- 212.0 KSI
ULT. STRENGTH: 228.5- 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.13

TABLE 6.8.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.14 INDICATING EFFECT

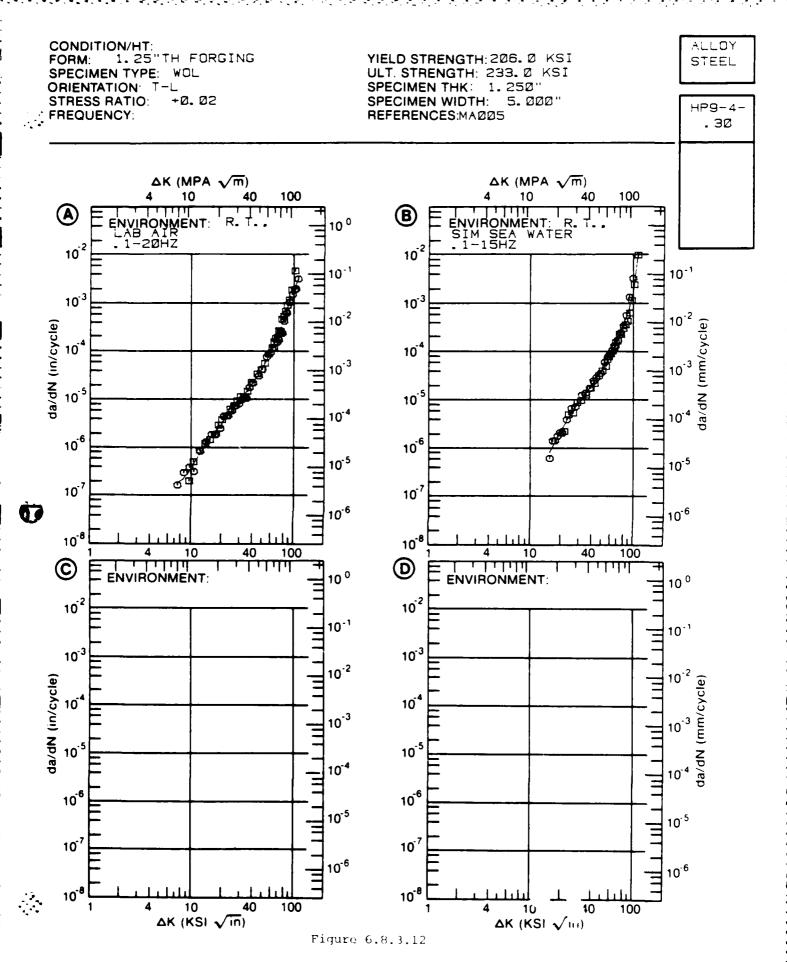### OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,3.5% NACL

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=-1.00			
A: 12.51		.87			
DELTA K B:					
MIN C:					
D:					
13.00		1.02			
16.00		1.65			
20.00		2.88			
25.00		5.84			
30.00		10.6			
35.00		16.7			
40.00		23.0			
50.00		33.9			
60.00		45.6			
70.00		63.7			
80.00		96.1			
90.00		158.			
A: 93.29		189.			
DELTA K B:					
MAX C:					
D:					

ROOT MEAN SQUARE   27.30
 PERCENT ERROR

LIFE   0.0-0.5
PREDICTION 0.5-0.8
 RATIO   0.8-1.25
 SUMMARY   1.25-2.0
 (NP/NA)   >2.0

CONDITION/HT: UTS-220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 0.10 HZ
ENVIRONMENT: R.T., 3.5% NACL

YIELD STRENGTH: 212.0 KSI
ULT. STRENGTH: 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
REFERENCES: MA007

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.14

6.8-43

TABLE 6.8.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.15 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: TUS=220-240KSI

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED	
DELTA K MIN	A: 11.34	.535			
	B: 11.28		.357		
	C: 11.21			.416	
	D:				
	13.00	.771	.665	.782	
	16.00	1.62	1.54	1.72	
	20.00	3.28	3.27	3.51	
	25.00	5.63	5.83	6.22	
	30.00	9.59	8.63	8.97	
	35.00	12.5	13.2	12.2	
	40.00		18.9	16.9	
	50.00			30.7	
DELTA K MAX	A: 35.32	12.1			
	B: 43.89		20.0		
	C: 55.99			36.1	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		21.34	19.96	15.01	

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: TUS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 10.00 HZ

YIELD STRENGTH:210.5 KSI
ULT. STRENGTH: 228.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900"
REFERENCES:MA010

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.15

TABLE 6.8.3.16

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL HP9-4-.30
CONDITION: TUS=220-240KSI

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED	
DELTA K MIN	A: 15.92	.79			
	B: 16.15		1.09		
	C: 15.84			2.32	
	D:				
	16.00	.768		2.40	
	20.00	1.54	2.70	4.71	
	25.00	4.11	5.59	7.74	
	30.00	7.80	8.98	11.4	
	35.00	12.3	12.6	16.3	
	40.00	17.3	16.6	22.1	
	50.00	29.0	25.8	34.4	
	60.00	43.4	38.2	43.0	
	70.00		55.8		
DELTA K MAX	A: 68.44	58.9			
	B: 78.64		77.6		
	C: 63.89			44.6	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		46.54	44.55	39.09	

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: TUS-220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 210.5 KSI
ULT. STRENGTH: 228.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900"
REFERENCES: MA010

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.16

TABLE 6.8.3.17

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.17 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: UTS=220-240KSI
ENVIRONMENT: R.T. ,3.5% NACL

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.10	F(HZ)= 1.00	F(HZ)= 10.00	
DELTA K MIN	A: 12.78	2.26			
	B: 12.97		1.34		
	C: 12.70			.813	
	D:				
	13.00	2.33	1.35	.859	
	16.00	3.66	2.45	1.46	
	20.00	6.21	4.25	2.74	
	25.00	9.50	7.00	5.25	
	30.00	12.8	10.5	8.77	
	35.00	16.7	15.1	13.1	
	40.00	21.6	21.3	17.8	
	50.00	36.3	41.1	27.7	
	60.00	59.5	78.4	40.6	
	70.00	94.7	149.	60.4	
	80.00	145.	284.	93.9	
	90.00	206.	540.	154.	
	100.00	260.		266.	
DELTA K MAX	A: 120.03	286.			
	B: 95.98		791.		
	C: 107.82			426.	
	D:				
ROOT MEAN SQUARE PERCENT ERROR		43.87	7.22	12.29	

LIFE   0.0-0.5
PREDICTION 0.5-0.8
 RATIO   0.8-1.25
 SUMMARY   1.25-2.0
 (NP/NA)   >2.0

CONDITION/HT: UTS=220-240KSI
FORM: 3.20"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
ENVIRONMENT: R.T., 3.5% NACL

YIELD STRENGTH: 212.0 KSI
ULT. STRENGTH: 229.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
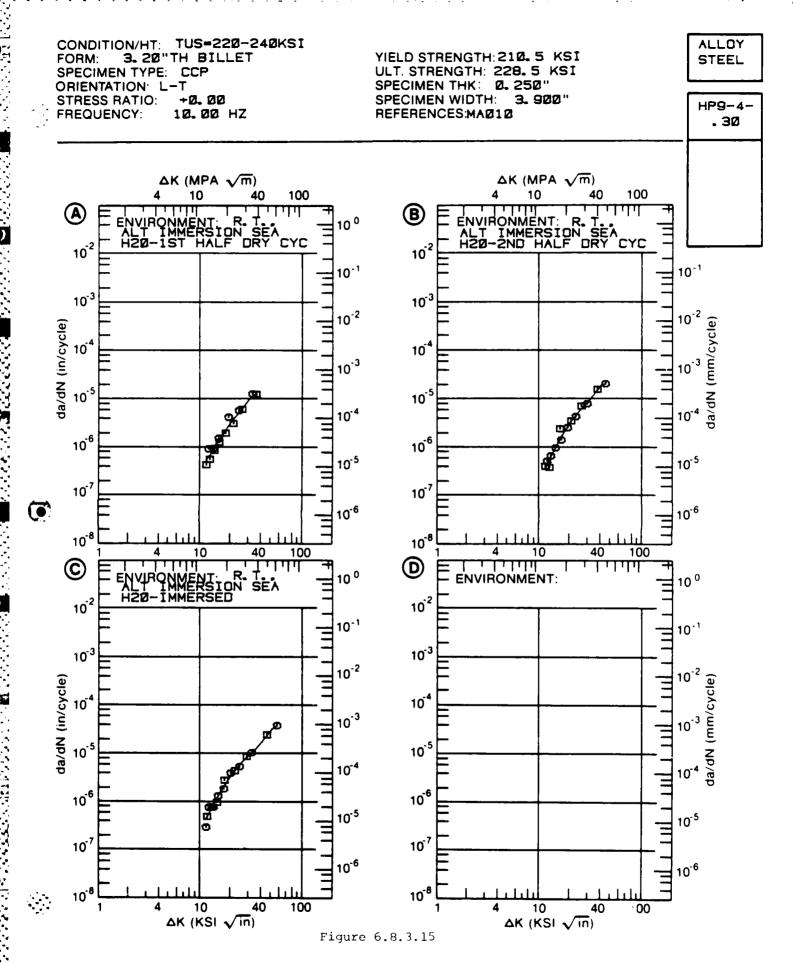REFERENCES: MA007

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.17

6.8-49

TABLE 6.8.3.18

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
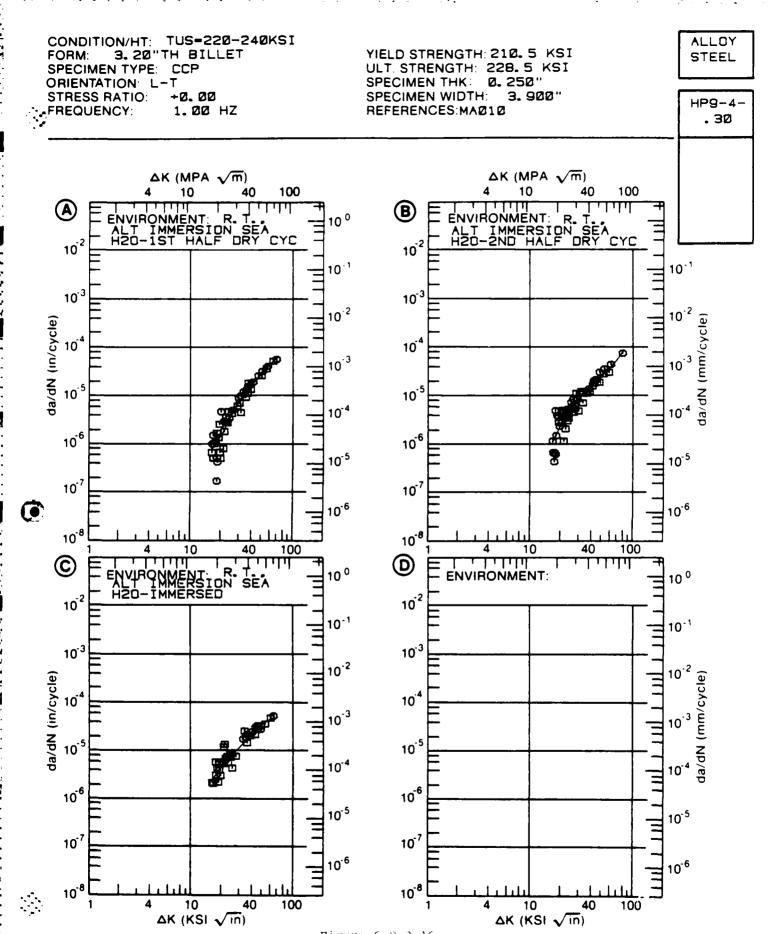
DATA ASSOCIATED WITH FIGURE 6.8.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1525F 2HRS OQ, -100F 1HR, 1025F 2+2HR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A.	E= R.T. S.T.W.		
DELTA K MIN A:	10.79	1.00			
B:	11.35		1.25		
C:					
D:					
	13.00	1.69	1.98		
	16.00	3.91	3.50		
	20.00		5.68		
	25.00		8.78		
	30.00		12.8		
	35.00		18.6		
	40.00		27.4		
	50.00		62.3		
	60.00		152.		
	70.00		388.		
DELTA K MAX A:	19.15	4.55			
B:	73.59		550.		
C:					
D:					

| ROOT MEAN SQUARE PERCENT ERROR | 12.92 | 8.85 | | |

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1	1	
	1.25-2.0			
	>2.0			

6.8-50

CONDITION/HT: 1525F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH:216.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 239.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.970- 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 4.970- 5.010"
FREQUENCY: 1.00 HZ   REFERENCES:88579

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.18

6.8-51

TABLE 6.8.3.19

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.19 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1525F 2HRS OQ,-100F 2HRS,1025F 2+2HR
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.30			
DELTA K MIN	A:	11.36	.756			
	B:					
	C:					
	D:					
		13.00	1.34			
		16.00	2.62			
		20.00	4.51			
		25.00	7.34			
		30.00	11.5			
		35.00	18.6			
		40.00	31.2			
		50.00	98.9			
		60.00	261.			
DELTA K MAX	A:	63.58	327.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR		9.89

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1525F 2HRS OQ. -100F 2HRS. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R. T. , L. H. A.

YIELD STRENGTH:216. 0 KSI
ULT. STRENGTH: 239. 6 KSI
SPECIMEN THK: 0. 970"
SPECIMEN WIDTH: 4. 970"
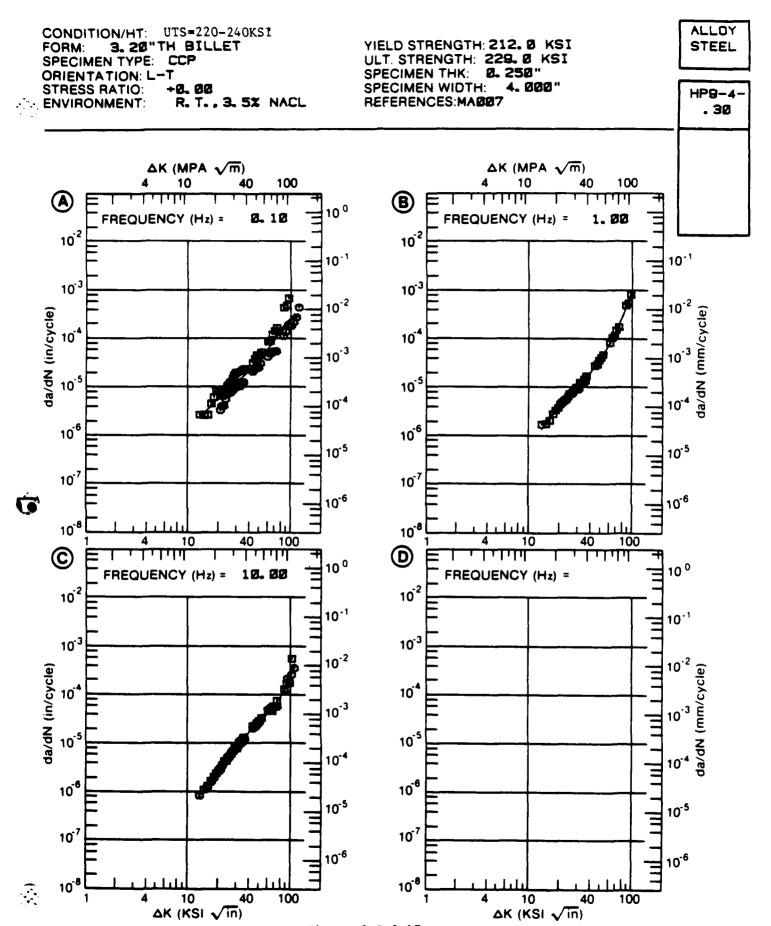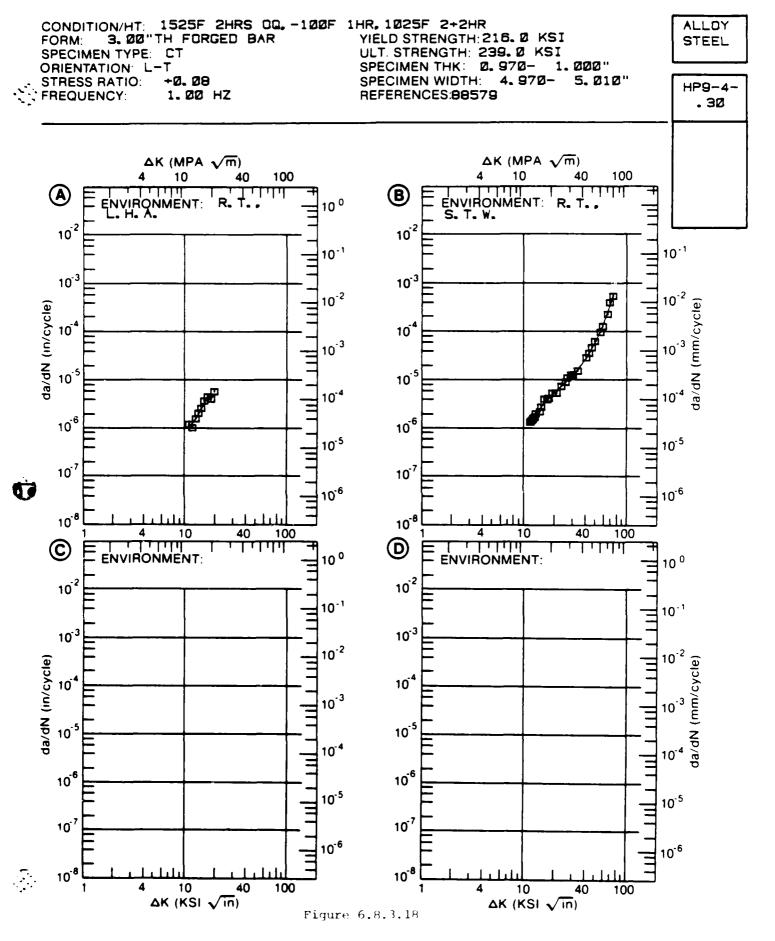REFERENCES:88579

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.19

TABLE 6.8.3.20

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.20 INDICATING EFFECT
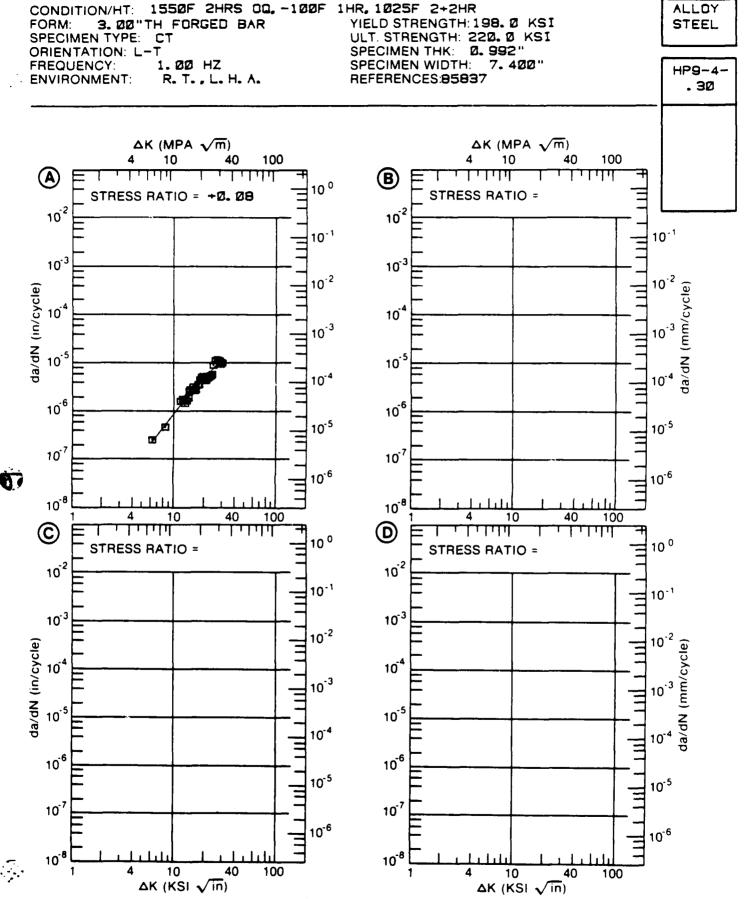
OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.30	R=+0.50		
DELTA K MIN A:	7.73	.529			
B:	7.94		.632		
C:					
D:					
	8.00	.581	.645		
	9.00	.816	.880		
	10.00	1.12	1.17		
	13.00	2.52	2.36		
	16.00	4.51	3.99		
	20.00	7.35	6.60		
	25.00	9.57	9.91		
DELTA K MAX A:	27.36	9.82			
B:	25.94		10.5		
C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	12.81	11.39		

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH:198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.988-   0.993"
FREQUENCY: 6.00 HZ   SPECIMEN WIDTH: 7.400"
ENVIRONMENT: R. T. , L. H. A.   REFERENCES:85837
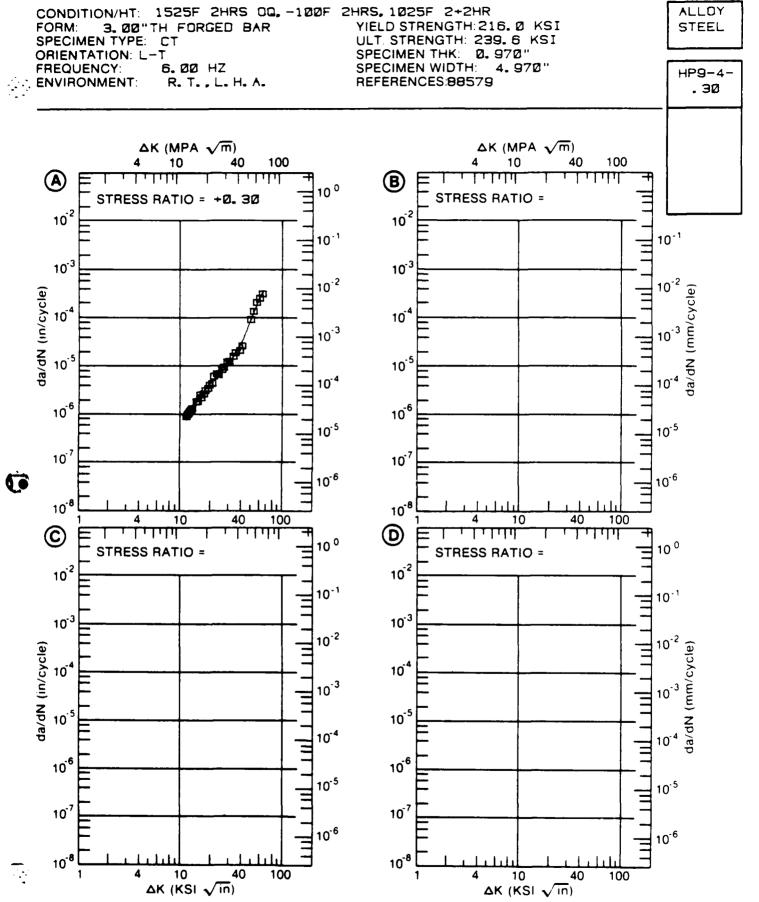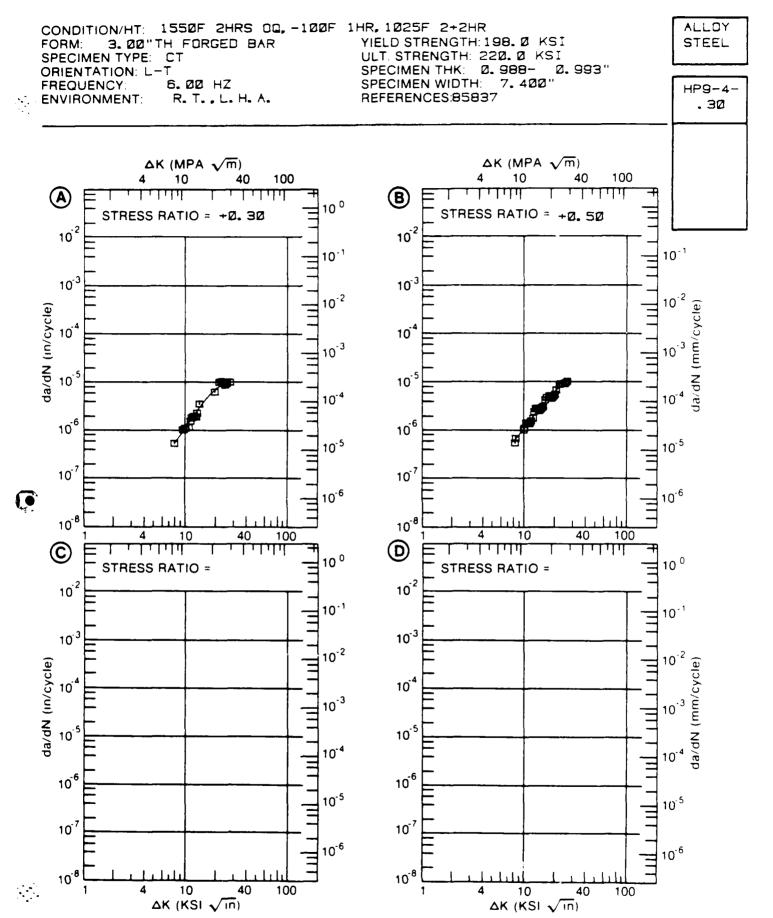
ALLOY STEEL

HP9-4-.30

Figure 6.6.3.20

6.6-9

TABLE 6.8.3.21

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.21 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR
ENVIRONMENT: R.T. , L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.08			
	A: 6.05	:	.226			
DELTA K B:		:				
MIN C:		:				
D:		:				
	7.00	:	.336			
	8.00	:	.485			
	9.00	:	.669			
	10.00	:	.890			
	13.00	:	1.78			
	16.00	:	3.00			
	20.00	:	5.04			
	25.00	:	8.05			
	A: 29.80	:	11.1			
DELTA K B:		:				
MAX C:		:				
D:		:				

ROOT MEAN SQUARE PERCENT ERROR	17.24

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH:198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.992"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 7.400"
ENVIRONMENT: R.T., L.H.A.   REFERENCES:85837

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.21

6.8-57

TABLE 6.8.3.22

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.22 INDICATING EFFECT

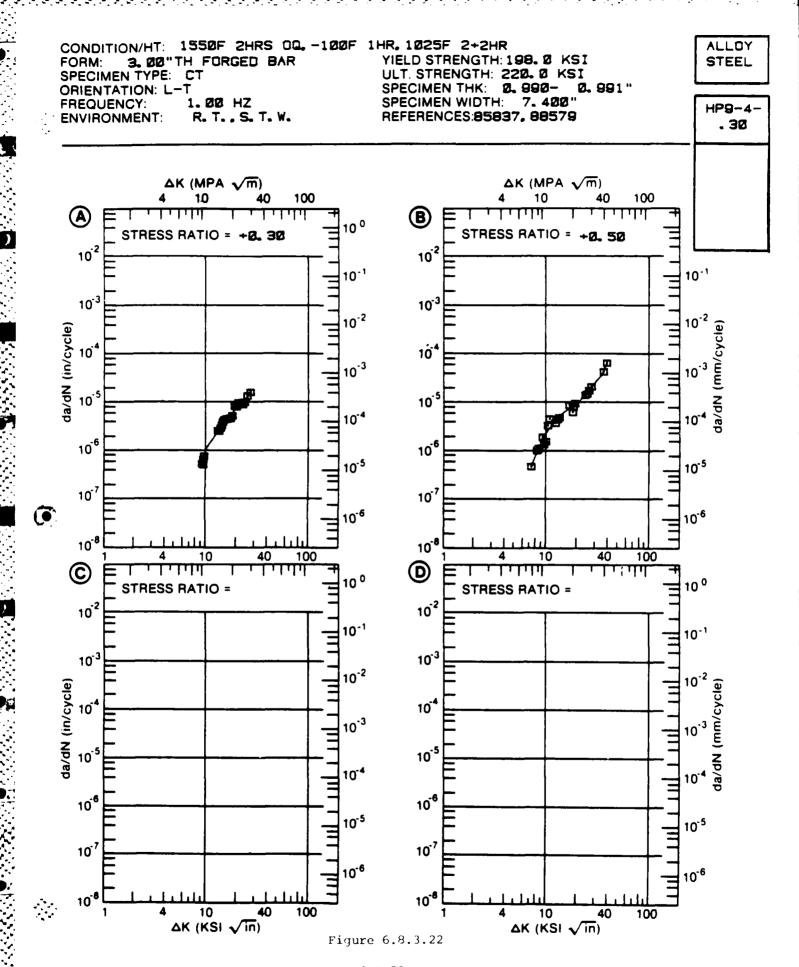### OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ,-100F 1HR,1025F 2+2HR
ENVIRONMENT: R.T. ,S.T.W.

DELTA K (KSI*IN**1/2)		:	DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.30	R=+0.50		
DELTA K MIN	A: 9.12	:	.449			
	B: 7.06	:		.454		
	C:	:				
	D:	:				
	8.00	:		.920		
	9.00	:		1.59		
	10.00	:	1.06	2.38		
	13.00	:	2.43	4.89		
	16.00	:	4.39	6.96		
	20.00	:	7.45	9.51		
	25.00	:	11.7	15.5		
	30.00	:		25.0		
	35.00	:		36.3		
DELTA K MAX	A: 27.24	:	15.3			
	B: 38.97	:		62.3		
	C:	:				
	D:	:				
ROOT MEAN SQUARE PERCENT ERROR			10.46	17.18		

LIFE PREDICTION RATIO SUMMARY (NP/NA)		A	B		
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH: 198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.990- 0.991"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 7.400"
ENVIRONMENT: R.T..S.T.W.   REFERENCES: 85837. 88579

Figure 6.8.3.22

TABLE 6.8.3.23

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.22 INDICATING EFFECT

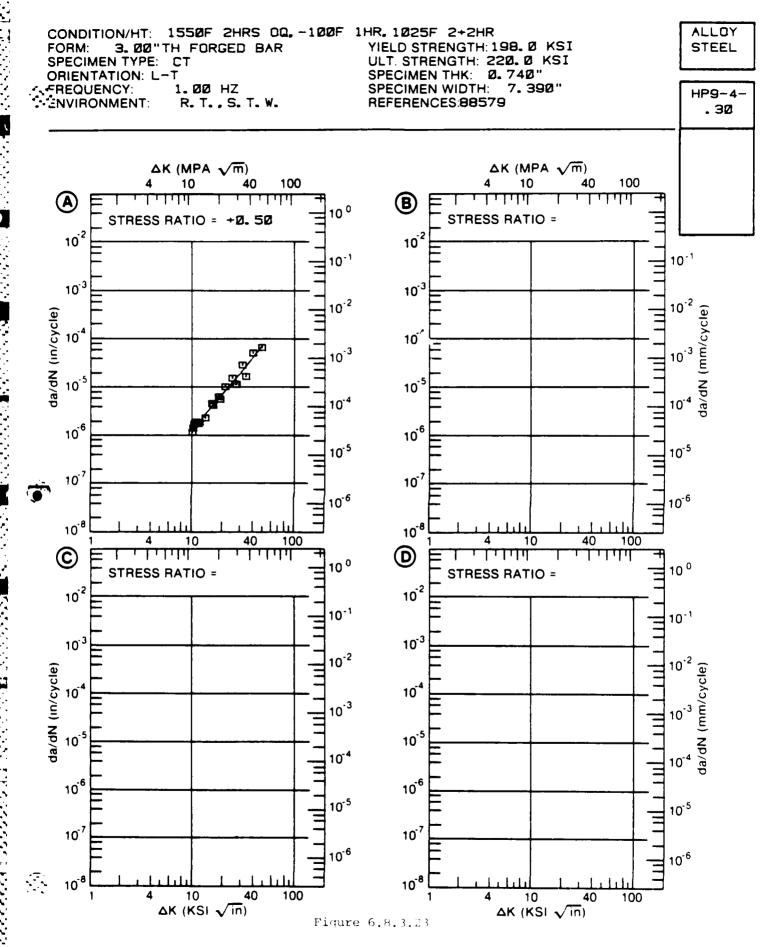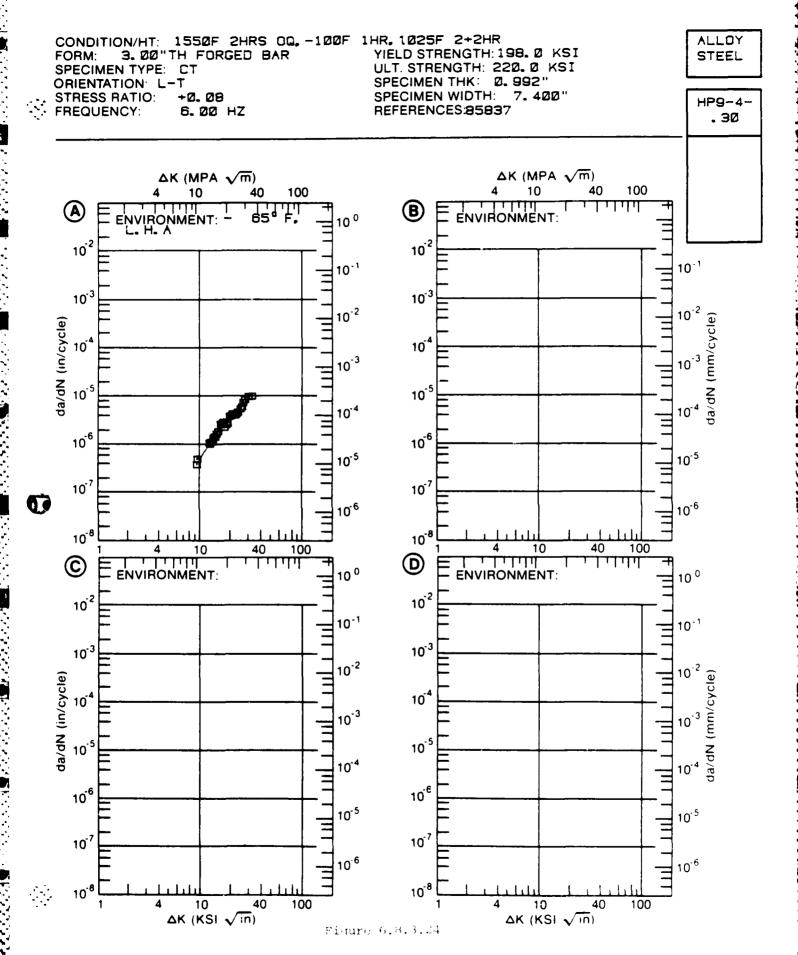### OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OG, -100F 1HR, 1025F 2+2HR
ENVIRONMENT: R.T. ,S.T.W.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.50			
DELTA K MIN	A:	9.77	1.26			
	B:					
	C:					
	D:					
		10.00	1.35			
		13.00	2.65			
		16.00	4.45			
		20.00	7.70			
		25.00	13.3			
		30.00	21.0			
		35.00	31.2			
		40.00	44.4			
DELTA K MAX	A:	47.24	69.8			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	18.04

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR

FORM: 3.00"TH FORGED BAR   YIELD STRENGTH:198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.740"
FREQUENCY: 1.00 HZ   SPECIMEN WIDTH: 7.390"
ENVIRONMENT: R. T.. S. T. W.   REFERENCES:88579

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.23

TABLE 6.8.3.24

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.24 INDICATING EFFECT

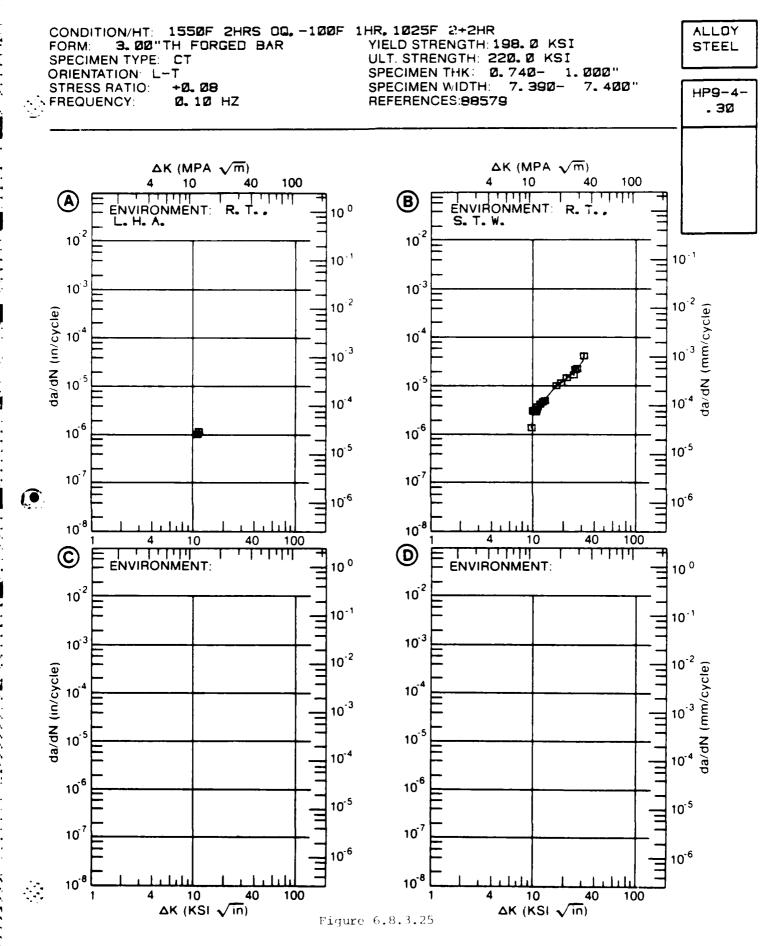### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=- 65F			
		L.H.A			
DELTA K MIN	A: 9.19	.482			
	B:				
	C:				
	D:				
	10.00	.508			
	13.00	1.23			
	16.00	2.15			
	20.00	3.59			
	25.00	5.91			
	30.00	9.32			
DELTA K MAX	A: 31.92	11.1			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE   11.36
PERCENT ERROR

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
0.0-0.5		
0.5-0.8		
0.8-1.25	1	
1.25-2.0		
>2.0		

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH: 198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.992"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 7.400"
FREQUENCY: 6.00 HZ   REFERENCES: 85837

ALLOY STEEL

HP9-4-.30

A — ENVIRONMENT: - 65° F. L. H. A

B — ENVIRONMENT:

C — ENVIRONMENT:

D — ENVIRONMENT:

Figure 6.8.3.24

6.8-63

TABLE 6.8.3.25

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.25 INDICATING EFFECT

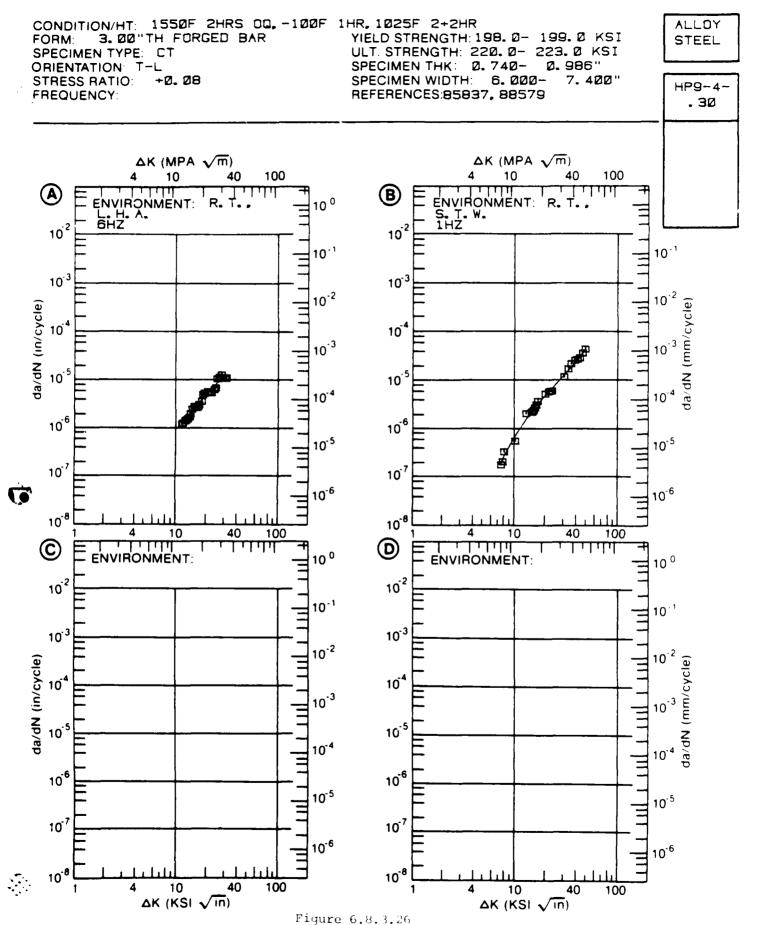### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R. T. L. H. A.	E= R. T. S. T. W.		
DELTA K MIN A:					
DELTA K MIN B:	9. 52		1. 36		
DELTA K MIN C:					
DELTA K MIN D:					
	10. 00		3. 00		
	13. 00		5. 35		
	16. 00		9. 17		
	20. 00		13. 2		
	25. 00		19. 1		
	30. 00		32. 3		
DELTA K MAX A:					
DELTA K MAX B:	30. 92		41. 3		
DELTA K MAX C:					
DELTA K MAX D:					

ROOT MEAN SQUARE PERCENT ERROR	0. 00	11. 98		

LIFE	0. 0-0. 5		
PREDICTION	0. 5-0. 8		
RATIO	0. 8-1. 25	1	
SUMMARY	1. 25-2. 0		
(NP/NA)	>2. 0		

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR, 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH: 198.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.740- 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 7.390- 7.400"
FREQUENCY: 0.10 HZ   REFERENCES: 98579

ALLOY
STEEL

HP9-4-
.30

Figure 6.8.3.25

TABLE 6.8.3.26

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.26 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 1HR, 1025F 2+2HR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A. 6HZ	E= R.T. S.T.W. 1HZ		
DELTA K MIN	A: 11.36	1.18			
	B: 7.33		.196		
	C:				
	D:				
	8.00		.289		
	9.00		.466		
	10.00		.688		
	13.00	1.67	1.60		
	16.00	2.89	2.81		
	20.00	5.13	4.84		
	25.00	8.51	8.07		
	30.00	11.9	12.2		
	35.00		17.7		
	40.00		24.9		
DELTA K MAX	A: 31.16	12.6			
	B: 48.54		42.8		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR		12.23	12.09		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5				
	0.5-0.8				
	0.8-1.25	1	1		
	1.25-2.0				
	>2.0				

CONDITION/HT: 1550F 2HRS OQ. -100F 1HR. 1025F 2+2HR
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH: 198.0- 199.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 220.0- 223.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.740- 0.986"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 6.000- 7.400"
FREQUENCY: REFERENCES:85837, 88579

ALLOY STEEL

HP9-4-.30

Figure 6.8.3.26

TABLE 6.8.3.27

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.8.3.27 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HP9-4-.30
CONDITION: 1550F 2HRS OQ, -100F 3HRS, 1000F 2+2HRS
ENVIRONMENT: R.T. , L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.08			
DELTA K MIN	A:	10.28	.922			
	B:					
	C:					
	D:					
		13.00	1.46			
		16.00	2.22			
		20.00	3.58			
		25.00	6.04			
		30.00	9.64			
		35.00	14.8			
		40.00	22.2			
		50.00	46.7			
		60.00	92.3			
		70.00	174.			
		80.00	315.			
DELTA K MAX	A:	88.40	507.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	20.51			

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5		
	0.5-0.8		
	0.8-1.25	1	
	1.25-2.0		
	>2.0		

CONDITION/HT: 1550F 2HRS OQ. -100F 3HRS. 1000F 2+2HRS
FORM: 3.00"TH FORGED BAR   YIELD STRENGTH: 215.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 244.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 0.970"
FREQUENCY: 6.00 HZ   SPECIMEN WIDTH: 4.980"
ENVIRONMENT: R.T.,L.H.A.   REFERENCES:88579

ALLOY STEEL

HP9-4-.30

Figure 6.5.7.27

6.5-69

TABLE 6.8.3.28

ALLOY STEEL   HP9-4-.30   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q)	K(ISCC) (KSI*SQRT IN)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
	F	1.25	R T	T-L	206.0	SIM SEA WATER	3.087	1.250	BWOL	1.379	----	41.60			----	1977	MA005
		1.25			206.0		3.085	1.251	BWOL	1.364	----	41.30			----	1977	MA005
	F	1.25	R T	S-T	204.5	SIM SEA WATER	3.079	1.250	BWOL	1.355	----	38.50			----	1977	MA005
		1.25			204.5		3.079	1.251	BWOL	1.365	----	38.60			----	1977	MA005
QUENCHED + TEMPERED AT 950F	P	0.48	R T	---	----	3.5 PCT NACL	1.500	0.500	NB	0.300	116.00	35.00*			----	1967	74302
		0.48			231.0		1.500	0.480	NB	----	116.00	45.00*			----	1967	74302

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.9.3.1

ALLOY STEEL   HP9-4-45   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (**=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1600F O SUR AC S / 15HRF O 33HR AC	S	0.08	R T	---	212.5	DIST. WATER	2.000	0.050	CNT	---	---	88.00*		20000	1968	72283
1600F O SUR AC S / 15HRF O 33HR AC	S	0.08	R T	---	212.5	3N NACL	2.000	0.050	CNT	---	---	35.00*		> 30000	1968	72283
REF	P	0.48	R T	---	220.0	3.5 PCT NACL	1.500	0.480	NB	0.300	89.00	20.00		---	1971	84351

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

6.9-1

TABLE 6.10.1.J

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL HY-TUF AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION	(NUMBER OF SPECIMENS)	

FORGING

CONDITION/HT	L-T	T-L	S-L
1700F 1HR, AC, 1600F 1HR, OQ, 550F 2HR	----	111.5 ± 2.1 (2)	----

6.10-1

TABLE 6.10.2.1

ALLOY STEEL   HY-TUF   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
1700F 1HR AC, 1600F 1HR+1000F 20 MIN.OQ,550F 2HR	F	6.50	R.T.	L-T	198.0	1.999	1.003	CT	0.988	0.92	120.00			1974	91284
1700F 1HR AC, 1600F 1HR+1000F 20 MIN.OQ,550F 2HR	F	6.50	R.T.	T-L	200.0	1.999	1.003	CT	0.977	0.80	113.00			1974	91284
1700F 1HR.AC, 1600F 1HR.OQ, 550F 2HR	F	6.50	R.T.	L-T	198.0	1.999	1.000	CT	0.983	0.86	116.00			1974	91284
1700F 1HR.AC, 1600F 1HR.OQ, 550F 2HR	F	6.50	R.T.	T-L	198.0	1.999	1.003	CT	0.977	0.76	110.00			1974	91284
	F	6.50			198.0	1.999	1.003	CT	0.973	0.81	113.00	111.5/	2.1	1974	91284

TABLE 6.11.3.1

ALLOY STEEL HY-150 K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1500F 1HR WQ	P	1.00	R.T.	---	150.0	3.0 PCT NACL	2.000	1.000	CANT*	0.200	-----	115.00*		> 30000	1968	73824

*NOTE: DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

6.11-1

TABLE 6.12.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL HY-180
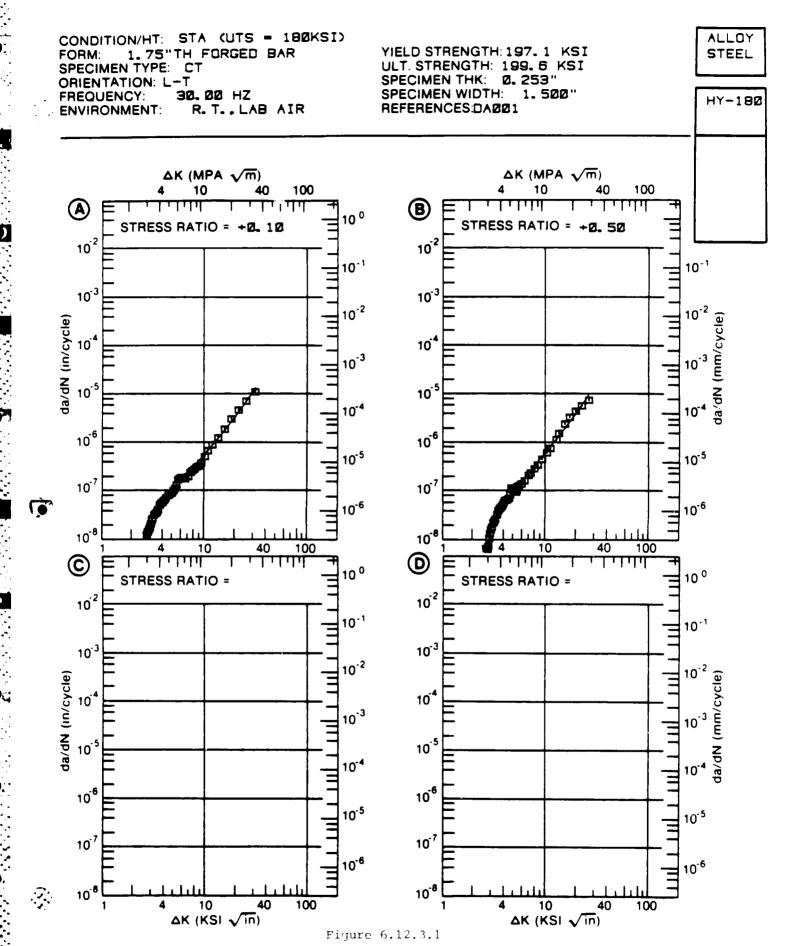
ENVIRONMENT LAB AIR
AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
STA (UTS = 180 KSI)	FORGED BAR	0.10	10.00					4.29	30.8	
STA (UTS = 180 KSI)	FORGED BAR	0.10	30.00			0.09	0.55	3.33		
STA (UTS = 180 KSI)	FORGED BAR	0.50	10.00					5.61		
STA (UTS = 180 KSI)	FORGED BAR	0.50	30.00			0.09	0.62	4.00		

TABLE 6.12.3.1
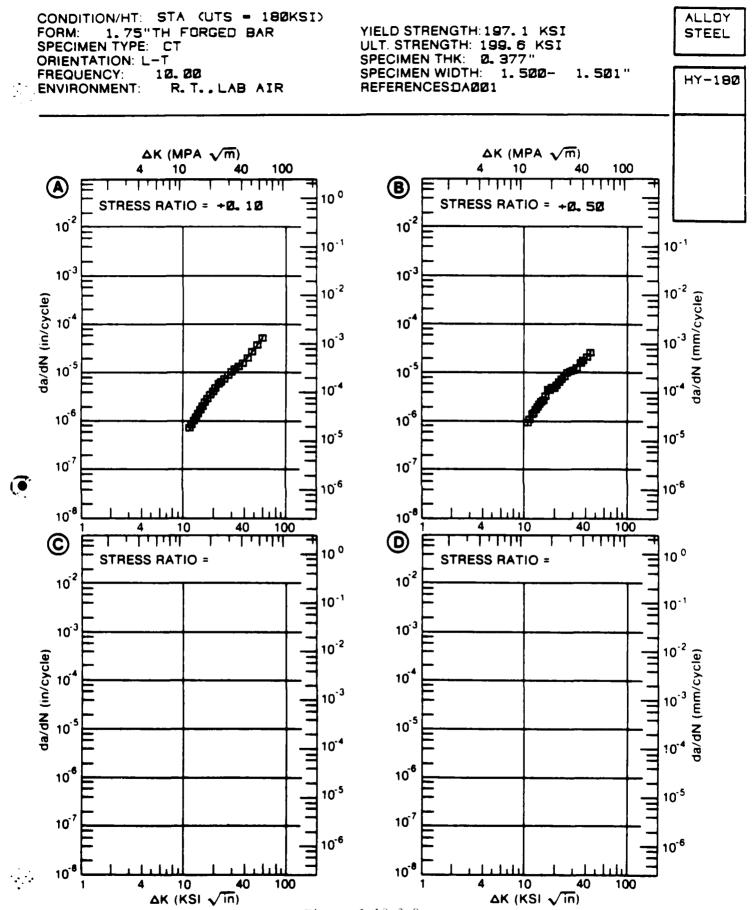
FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HY-180
CONDITION: STA (UTS = 180KSI)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
A: 2.72	:	.0170			
DELTA K B: 2.62	:		.0105		
MIN C:	:				
D:	:				
3.00	:	.0232	.0179		
3.50	:	.0368	.0313		
4.00	:	.0539	.0491		
5.00	:	.0986	.0979		
6.00	:	.158	.164		
7.00	:	.232	.248		
8.00	:	.322	.351		
9.00	:	.430	.474		
10.00	:	.556	.620		
13.00	:	1.07	1.21		
16.00	:	1.82	2.11		
20.00	:	3.33	4.00		
25.00	:	6.36	8.07		
30.00	:	11.2			
A: 31.28	:	12.9			
DELTA K B: 26.38	:		9.67		
MAX C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	14.34	21.78		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: STA (UTS = 180KSI)
FORM: 1.75"TH FORGED BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 197.1 KSI
ULT. STRENGTH: 199.6 KSI
SPECIMEN THK: 0.253"
SPECIMEN WIDTH: 1.500"
REFERENCES: DA001

ALLOY
STEEL

HY-180

Figure 6.12.3.1

TABLE 6.12.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HY-180
CONDITION: STA (UTS = 180KSI)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
DELTA K MIN A:	11.51	.645			
B:	10.71		.899		
C:					
D:					
	13.00	1.10	1.84		
	16.00	2.31	3.37		
	20.00	4.29	5.61		
	25.00	7.04	8.57		
	30.00	10.1	11.9		
	35.00	13.6	15.8		
	40.00	18.0	20.6		
	50.00	30.8			
DELTA K MAX A:	59.28	51.3			
B:	43.61		25.0		
C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR	3.94	5.39

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	1
SUMMARY	1.25-2.0		
(NP/NA)	>2.0		

CONDITION/HT: STA (UTS = 180KSI)

FORM: 1.75"TH FORGED BAR

SPECIMEN TYPE: CT

ORIENTATION: L-T

FREQUENCY: 10.00

ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 197.1 KSI

ULT. STRENGTH: 199.6 KSI

SPECIMEN THK: 0.377"

SPECIMEN WIDTH: 1.500- 1.501"

REFERENCES: DA001

ALLOY STEEL

HY-180

Figure 6.12.3.2

TABLE 6.12.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.12.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   HY-80
CONDITION:
ENVIRONMENT: R.T. ,3.5% NACL

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10			
DELTA K MIN	A:	24.02	5.47			
	B:					
	C:					
	D:					
		25.00	5.88			
		30.00	8.35			
		35.00	11.6			
		40.00	15.8			
		50.00	28.1			
		60.00	48.0			
		70.00	79.2			
DELTA K MAX	A:	77.74	114.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	9.48

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM:
SPECIMEN TYPE: WOL
ORIENTATION:
FREQUENCY: 0. 50 HZ
ENVIRONMENT: R. T. . 3. 5% NACL

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0. 400"
SPECIMEN WIDTH: 2. 550"
REFERENCES:UD007

| ALLOY STEEL |
| HY-80 |

Figure 6.12.3.3

6.12-7

TABLE 6.13.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL H11

ENVIRONMENT LAB AIR AT R T

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	10	20	50	100
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.10	10.00				3.53		
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.10	30.00			0.33	2.95		
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.50	10.00				4.74		
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.50	20.00		0.09	0.73	4.56		

TABLE 6.13.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR
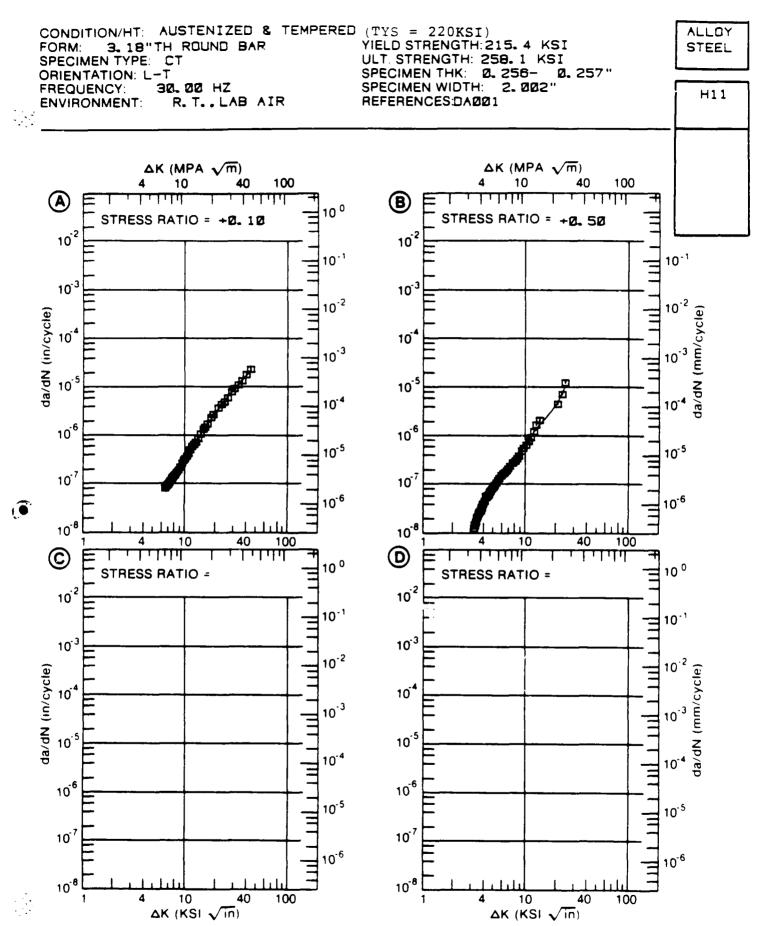
ALLOY STEEL H11

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT   AIR
AT   650 F

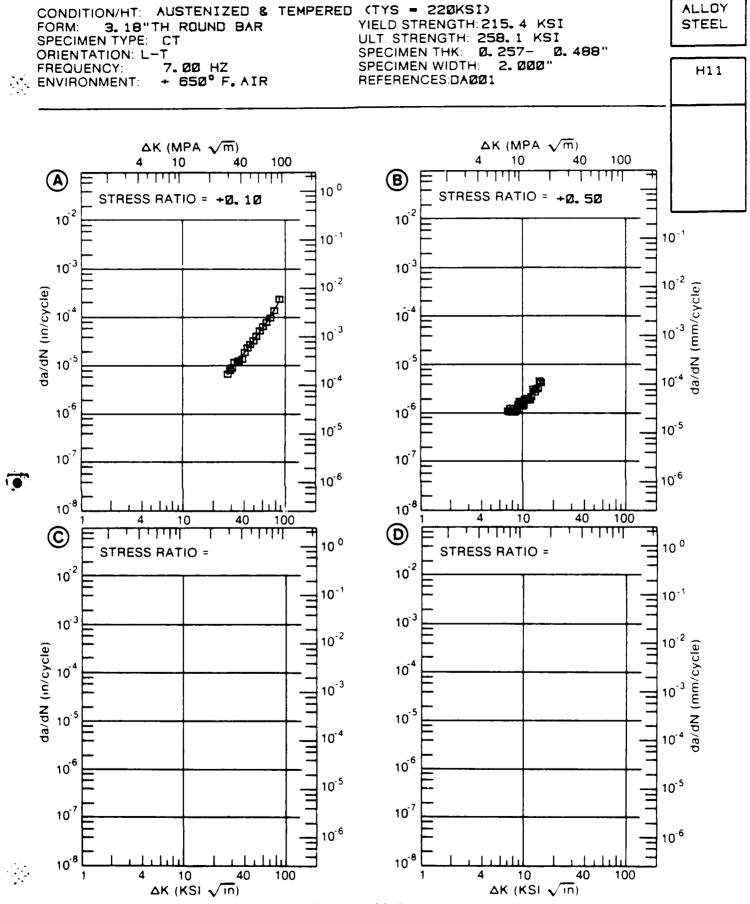| CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100	
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.10	7.00					34.6		
AUSTENIZED & TEMPERED (TYS = 220KSI)	ROUND BAR	0.50	7.00			1.61				

TABLE 6.13.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
A:	6.34	.0757			
DELTA K B:	3.07		.0168		
MIN C:					
D:					
	3.50		.0269		
	4.00		.0428		
	5.00		.0905		
	6.00		.163		
	7.00	.105	.262		
	8.00	.163	.390		
	9.00	.240	.549		
	10.00	.339	.738		
	13.00	.791	1.49		
	16.00	1.51	2.52		
	20.00	2.95	4.56		
	25.00	5.52			
	30.00	8.88			
	35.00	12.9			
	40.00	17.4			
A:	44.01	21.3			
DELTA K B:	23.97		10.5		
MAX C:					
D:					

| ROOT MEAN SQUARE PERCENT ERROR | | 4.06 | 13.76 | | |

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR   YIELD STRENGTH:215.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 258.1 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.256- 0.257"
FREQUENCY: 30.00 HZ   SPECIMEN WIDTH: 2.002"
ENVIRONMENT: R.T..LAB AIR   REFERENCES:DA001

Figure 6.15.3.1

6.15-

TABLE 6.13.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
DELTA K MIN	A: 12.92	.949			
	B: 10.54		.691		
	C:				
	D:				
	13.00	.970	1.41		
	16.00	1.90	2.66		
	20.00	3.53	4.94		
	25.00	6.19			
	30.00	9.73			
	35.00	14.5			
	40.00	20.9			
DELTA K MAX	A: 42.50	24.9			
	B: 22.18		6.46		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	1.90	2.05		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5			
	0.5-0.8			
	0.8-1.25	1	1	
	1.25-2.0			
	>2.0			

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR   YIELD STRENGTH:215.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 258.1 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.488"
FREQUENCY: 10.00 HZ   SPECIMEN WIDTH: 2.005- 2.010"
ENVIRONMENT: R.T., LAB AIR   REFERENCES:DA001

ALLOY
STEEL

H11

Figure 6.13.3.2

TABLE 6.13.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.3 INDICATING EFFECT

OF STRESS RATIO
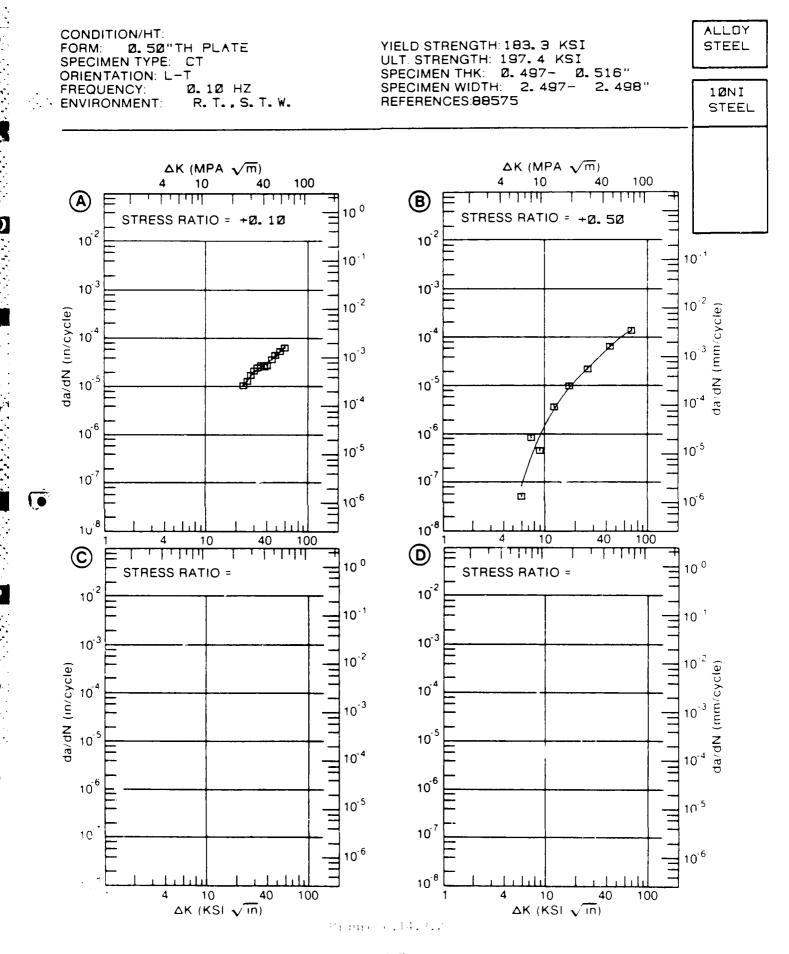
MATERIAL: ALLOY STEEL   H11
CONDITION: AUSTENIZED & TEMPERED (TYS = 220KSI)
ENVIRONMENT: + 650F, AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
DELTA K MIN	A: 27.33	7.00			
	B: 7.01		1.03		
	C:				
	D:				
	8.00		1.17		
	9.00		1.36		
	10.00		1.61		
	13.00		2.97		
	16.00				
	20.00				
	25.00				
	30.00	8.83			
	35.00	13.1			
	40.00	18.6			
	50.00	34.6			
	60.00	59.8			
	70.00	97.9			
	80.00	154.			
DELTA K MAX	A: 87.90	216.			
	B: 14.69		4.42		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		6.82	11.15		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5				
	0.5-0.8				
	0.8-1.25	1	1		
	1.25-2.0				
	>2.0				

CONDITION/HT: AUSTENIZED & TEMPERED (TYS = 220KSI)
FORM: 3.18"TH ROUND BAR   YIELD STRENGTH:215.4 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 258.1 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.257- 0.488"
FREQUENCY: 7.00 HZ   SPECIMEN WIDTH: 2.000"
ENVIRONMENT: + 650° F. AIR REFERENCES:DA001

Figure 6.13.3.3

6.13-9

TABLE 6.13.3.4

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.13.3.4 INDICATING EFFECT

OF ENVIRONMENT
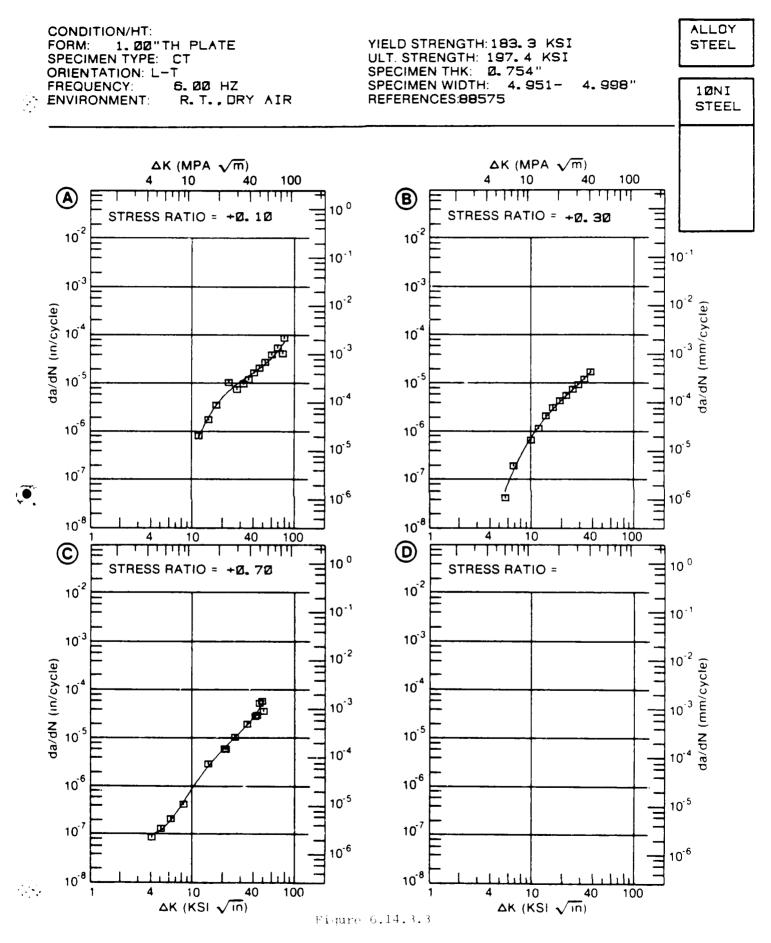
MATERIAL: ALLOY STEEL H11
CONDITION:

K MAX (KSI*IN**1/2)			DA/DT (10**-3 IN/HOUR)			
		:	A	B	C	D
		:	E= DIST. WATER	E= ARGON, 100% REL HUM		
K MAX MIN	A: 17.50	:	15.4			
	B: 22.50	:		876.		
	C:	:				
	D:	:				
	20.00	:	81.2			
	25.00	:	573.	1089.		
	30.00	:	1648.	2424.		
	35.00	:	3253.	3552.		
K MAX MAX	A: 38.50	:	4763.			
	B: 37.00	:		5024.		
	C:	:				
	D:	:				
ROOT MEAN SQUARE PERCENT ERROR			69.12	18.74		

CONDITION/HT:
FORM:
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 230.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.080 -   0.125"
SPECIMEN WIDTH:
CRACK LENGTH (A_O):
K_{ISCC}:
REFERENCES: 75111. 84309

Figure 6.13.3.4

TABLE 6.13.3.5

ALLOY STEEL   H11   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK DESIGN (IN) (*=SG) B	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
QUENCHED + TEMPERED AT 1100F	P	0 48	R T	---	188 0	3 5 PCT NACL	1.500	0 480	---	---	54 00	30 00	---	1971	84351
1325F, 1850F 0 5HR AC, 1060F 2+2HR	S	0 08	R T	---	205 6	DIST WATER	2 000	0 050 CNT	---	---	---	35 00*	4000	1968	72283
1325F, 1850F 0 5HR AC, 1060F 2+2HR	S	0 08	R T	---	205 6	3N NACL	2 000	0 050 CNT	---	---	---	28 00*	> 20000	1968	72293

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2 5(KISCC/TYS)SQUARED

TABLE 6.14.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 18NI STEEL

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT   DRY AIR
              AT RT

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)			
				2.5	5	10	20	50	100
---	PLATE	0.10	6.00				5.20	22.9	
	PLATE	0.10	6.00				3.90	25.2	
	PLATE	0.30	6.00			0.44	4.64		
	PLATE	0.50	6.00		0.09	0.80	4.70		
	PLATE	0.70	6.00		0.12	0.93	5.76		

6.14-1

TABLE 6.14.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 10NI STEEL

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

ENVIRONMENT S T W
AT R T

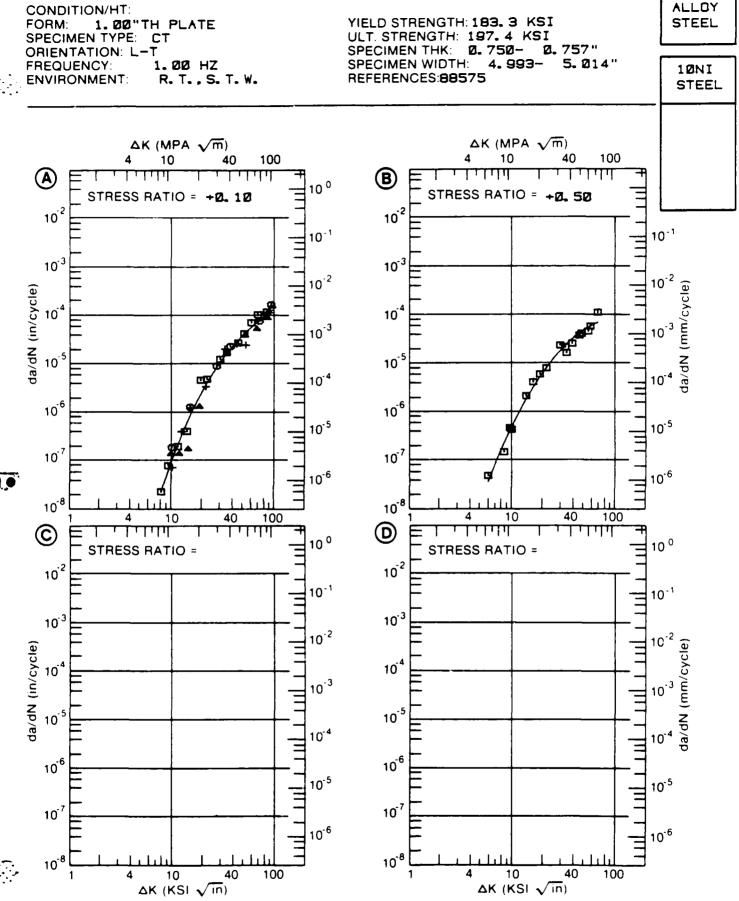| CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2 5	5	10	20	50	100
	PLATE	0.10	0.10					43.5	
	PLATE	0.10	1.00			0.11	2.92	40.4	
	PLATE	0.50	0.10			1.60	13.1	85.2	
	PLATE	0.50	1.00			0.52	6.48	48.3	

TABLE 6.14.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   10NI STEEL
CONDITION:
ENVIRONMENT: R.T. , DRY AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10	R=+0.50		
DELTA K MIN	A:	7.88	.165			
	B:	4.05		.069		
	C:	2				
	D:					
		5.00		.0971		
		6.00		.168		
		7.00		.294		
		8.00	.177	.484		
		9.00	.294	.730		
		10.00	.449	1.00		
		13.00	1.14	1.89		
		16.00	2.15	2.89		
		20.00	3.90	4.70		
		25.00	6.57	7.57		
		30.00	9.64	10.4		
		35.00	13.1			
		40.00	16.8			
		50.00	25.2			
		60.00	35.0			
		70.00	46.6			
DELTA K MAX	A:	71.09	48.0			
	B:	34.16		12.1		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	33.80	24.26		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25			
SUMMARY	1.25-2.0	1	1	
(NP/NA)	>2.0			

6.14-4

CONDITION/HT:
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH:183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.494"
SPECIMEN WIDTH: 2.494-   2.496"
REFERENCES:88575

Figure 6.14.5.1

TABLE 6.14.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   10NI STEEL
CONDITION:
ENVIRONMENT: R.T. , S.T.W.

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	R=+0.10	R=+0.50		
A: 23.16	:	9.91			
DELTA K B: 5.79	:		.0829		
MIN C:	:				
D:	:				
6.00	:		.106		
7.00	:		.278		
8.00	:		.576		
9.00	:		1.02		
10.00	:		1.60		
13.00	:		4.12		
16.00	:		7.55		
20.00	:		13.1		
25.00	:	12.8	21.2		
30.00	:	19.9	30.7		
35.00	:	25.5	42.1		
40.00	:	30.5	55.3		
50.00	:	43.5	85.2		
60.00	:		114.		
A: 59.08	:	66.0			
DELTA K B: 69.37	:		136.		
MAX C:	:				
D:	:				

| ROOT MEAN SQUARE | 6.88 | 78.50 | |
| PERCENT ERROR | | | |

LIFE	0.0-0.5		
PREDICTION	0.5-0.8		
RATIO	0.8-1.25	1	
SUMMARY	1.25-2.0		1
(NP/NA)	>2.0		

CONDITION/HT:
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 0.10 HZ
ENVIRONMENT: R. T., S. T. W.

YIELD STRENGTH: 183. 3 KSI
ULT. STRENGTH: 197. 4 KSI
SPECIMEN THK: 0. 497- 0. 516"
SPECIMEN WIDTH: 2. 497- 2. 498"
REFERENCES: 88575

ALLOY
STEEL

10NI
STEEL

TABLE 6.14.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   10NI STEEL
CONDITION:
ENVIRONMENT: R.T. , DRY AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.30	R=+0.70	
DELTA K MIN A:	11.50	.739			
B:	5.39		.0561		
C:	3.91			.0937	
D:					
	4.00			.0943	
	5.00			.122	
	6.00		.0993	.185	
	7.00		.207	.290	
	8.00		.362	.446	
	9.00		.563	.660	
	10.00		.807	.931	
	13.00	1.31	1.73	2.03	
	16.00	2.82	2.88	3.44	
	20.00	5.20	4.64	5.76	
	25.00	8.14	7.25	9.31	
	30.00	10.9	10.4	13.7	
	35.00	13.5	14.4	19.3	
	40.00	16.2		27.3	
	50.00	22.9			
	60.00	32.6			
	70.00	47.4			
DELTA K MAX A:	79.57	69.3			
B:	37.57		16.8		
C:	48.99			55.8	
D:					

ROOT MEAN SQUARE PERCENT ERROR	21.23	12.49	53.40

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25			
SUMMARY	1.25-2.0	1	1	1
(NP/NA)	>2.0			

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 6.00 HZ
ENVIRONMENT: R.T., DRY AIR

YIELD STRENGTH: 183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.754"
SPECIMEN WIDTH: 4.951- 4.998"
REFERENCES: 88575

Figure 6.14.3.3

TABLE 6.14.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   10NI STEEL
CONDITION:
ENVIRONMENT: R.T. ,S.T.W.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
DELTA K MIN A:	7.72	.0224			
B:	5.73		.0357		
C:					
D:					
	6.00		.0456		
	7.00		.100		
	8.00	.0283	.191		
	9.00	.0594	.328		
	10.00	.111	.521		
	13.00	.449	1.50		
	16.00	1.18	3.17		
	20.00	2.92	6.48		
	25.00	6.43	12.1		
	30.00	11.3	18.9		
	35.00	17.4	26.3		
	40.00	24.4	33.9		
	50.00	40.4	48.3		
	60.00	58.1	60.6		
	70.00	76.8			
	80.00	96.1			
	90.00	116.			
DELTA K MAX A:	95.02	126.			
B:	68.00		68.6		
C:					
D:					

ROOT MEAN SQUARE PERCENT ERROR		33.58	34.04		

LIFE PREDICTION RATIO SUMMARY (NP/NA)					
LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0	1			
(NP/NA)	>2.0	2			

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 1.00 HZ
ENVIRONMENT: R. T., S. T. W.

YIELD STRENGTH: 183. 3 KSI
ULT. STRENGTH: 197. 4 KSI
SPECIMEN THK: 0. 750-   0. 757"
SPECIMEN WIDTH: 4. 993-   5. 014"
REFERENCES:88575

ALLOY STEEL

10NI STEEL

Figure 6.14.3.4

6.14-11

TABLE 6.14.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.14.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   10NI STEEL
CONDITION:

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. S.T.W.			
DELTA K MIN	A: 10.71	.0314			
	B:				
	C:				
	D:				
	13.00	.160			
	16.00	.661			
	20.00	2.21			
	25.00	5.63			
	30.00	10.3			
	35.00	15.5			
	40.00	21.2			
	50.00	33.0			
	60.00	46.0			
	70.00	60.9			
	80.00	79.1			
	90.00	102.			
	100.00	131.			
	130.00	285.			
DELTA K MAX	A: 138.84	360.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE   28.84
 PERCENT ERROR

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
0.0-0.5		
0.5-0.8		
0.8-1.25	1	
1.25-2.0		
>2.0		

CONDITION/HT:
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH:183.3 KSI
ULT. STRENGTH: 197.4 KSI
SPECIMEN THK: 0.755"
SPECIMEN WIDTH: 5.001"
REFERENCES:88575

ALLOY
STEEL

10NI
STEEL

Figure 6.14.3.5

6.14-13

TABLE 6.15.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 12-9-2 MAR

TEST CONDITIONS

SPECIMEN ORIENTATION   L-T

ENVIRONMENT   LAB AIR AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2 5	5	10	20	50	100
STA 900	ROUND BAR	0 10	10 00					8 17		
STA 905	ROUND BAR	0 10	30 00				0 14	8 92		

TABLE 6.15.2.1

ALLOY STEEL   12-9-2(MAR)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	K(IC) STAN DEV	DATE	REFER
STA 900	BR	3.00	R T	L-T	251.3	2.005	0.958	CT	0.942	0.03	29.60			1979	DA001

TABLE 6.15.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.15.3.1 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   12-9-2 MAR
CONDITION: STA 900
ENVIRONMENT: R.T. , LAB AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	F(HZ)= 10.00 SP. THK. =.503"	F(HZ)= 30.00 SP. THK. =.253"		
DELTA K MIN A: 12.68	:	.730			
B: 6.95	:		.014		
C: 6	:				
D:	:				
7.00	:		.0154		
8.00	:		.0401		
9.00	:		.0829		
10.00	:		.149		
13.00	:	.863	.581		
16.00	:	2.68	1.86		
20.00	:	8.17	8.92		
DELTA K MAX A: 23.91	:	27.8			
B: 21.41	:		15.9		
C:	:				
D:	:				

ROOT MEAN SQUARE PERCENT ERROR	11.25	14.09		

LIFE PREDICTION RATIO SUMMARY (NP/NA)			
0.0-0.5			
0.5-0.8			
0.8-1.25	1	1	
1.25-2.0			
>2.0			

CONDITION/HT STA 900
FORM: 3.00"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 251.3 KSI
ULT. STRENGTH: 257.3 KSI
SPECIMEN THK:
SPECIMEN WIDTH: 1.990- 1.991"
REFERENCES: DA001

ALLOY
STEEL

12-9-
2 MAR

(A) FREQUENCY (Hz) = 10.00
SP. THK = 0.503"

(B) FREQUENCY (Hz) = 30.00
SP. THK = 0.253"

(C) FREQUENCY (Hz) =

(D) FREQUENCY (Hz) =

ΔK (MPA √m)

da/dN (in/cycle)

da/dN (mm/cycle)

ΔK (KSI √in)

Figure 6.1.2.1

6.1-5

TABLE 6.16.3.1

ALLOY STEEL   12NI-5CR-3MO   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK DESIGN (IN) (#=SG) B	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
		---	R T	---	184 0	SYNTH SEAWATER	---	--- CANT	---	------	38 00		---	1969	74232
		---		---			---	---	---	------	50 00	44 0/ 8 5	---	1969	74232
	P	1 00	R T	T-S	185 0	3 5 PCT NACL	---	--- CANT	---	135 00	83 00		4800	1967	70887
		1 00	R T	---	185 0	3 5 PCT NACL	3 200	1 000 WOL *	1 520	95 80	43 60		---	1969	84317
		1 00		---	185 0		---	--- CANT*	---	138 00	44 00		---	1969	84317
		1 00		---	170 0		3 200	1 000 WOL *	1 520	85 00	52 00		---	1969	84317
		1 00		---	190 0		---	--- CANT*	---	123 00	50 00	47 4/ 4 2	---	1969	84317
PRECRACK CHARPY	P	1 00	R T	---	176 0	SYNTH SEAWATER	1 000	1 000 CANT*	---	130 00	40 00		> 60000	1966	65166
GTA WELDED	H	1 00	R T	---	178 0	SYNTH SEAWATER	---	---	---	------	33 00		---	1969	74232
LOW-RESIDUAL	P	1 00	R T	---	183 0	SYNTH SEAWATER	1 000	1 000 CANT*	-:-	169 00	108 00		> 60000	1966	65166
1ST 150 GKSI	P	1 00	R T	---	150 0	3 5 PCT NACL	---	1 000 CANT*	---	150 00	130 00*		---	1972	83613
1ST 160 GKSI	P	1 00	R T	---	160 0	3 5 PCT NACL	---	1 000 CANT*	---	205 00	130 00*		---	1972	83613
1ST 170 GKSI	P	1 00	R T	---	170 0	3 5 PCT NACL	---	1 000 CANT*	---	155 00	110 00*		---	1972	83613
1ST 175 GKSI	P	1 00	R T	---	175 0	3 5 PCT NACL	---	1 000 CANT*	---	140 00	105 00*		---	1972	83613

*DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2 5(KISCC/TYS)SQUARED

TABLE 6.16.3.1 (Cont'd).

ALLOY STEEL   12NI-5CR-3MO   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR BTR	YIELD (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SC)	CRACK LENGTH (IN) A	K(0) (KSI*SQRT IN)	K(ISCC) MEAN	BTAN DEV	TEST TIME (MIN)	DATE	REFER
1500F,900F 20HR AC	P	1.00	RT	L-B	176	0 3.5 PCT NACL	2.500	0.500	CANT*	---	249.00	80.00		---	1970	B4342
1500F,900F 20HR AC	P	1.00	RT	T-S	176	0 3.5 PCT NACL	2.50	0.500	CANT*	---	246.00	70.00		---	1970	B4342

6.16-2

TABLE 6.17.3.1

ALLOY STEEL   18NI(180)(MAR) K(ISCC)

PRODUCT FORM	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) B	SPECIMEN THICK DESIGN (IN) (*=SG) B	CRACK LENGTH (IN) A	K(0) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
P	RT		170.0	3.5 PCT NACL	----	1.000 CANT*	----	160.00	140.00*		----	1972	84613
P	RT		175.0	3.5 PCT GL	----	1.000 CANT*	----	160.00	125.00*		----	1972	84613
P	RT		178.0	SYNTH SEAWATER	1.000	1.000 CANT*	----	118.00	108.00		> 60000	1966	65164
P	RT		185.0	3.5 PCT NACL	----	1.000 CANT*	----	180.00	130.00*		----	1972	83613
P	RT		190.0	3.5 PCT NACL	----	1.000 CANT*	----	170.00	120.00*		----	1972	83613
P	RT		175.0	3.5 PCT NACL	----	1.000 CANT*	----	165.00	60.00		----	1972	84613
P	RT		200.0	3.5 PCT NACL	----	1.000 CANT*	----	190.00	105.00		----	1972	83613
P	RT 1-S		177.0	SEAWATER	----	---- CANT	----	----	143.00*		----	1971	81004
P	RT 1-S		177.0	3.5 PCT NACL	----	---- CANT	----	----	130.00*		> 30000	1971	91004

SPECIMEN THICKNESS DID NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.18.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 18NI(200)(MAR) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS)		
	(KSI SQRT(IN)) DEVIATION		
	PLATE		
CONDITION/HT	L-T	T-L	S-L
1650F 4.5 HR, AC,AGED 1000F 6 HR	102.3 ± 1.2 (3)	---	---
1650F 4.5 HR, AC,AGED 950F 24 HR	99.3 ± 1.2 (3)	---	---
1650F 4.5 HR, AC,AGED 900F 24 HR	96.5 ± 0.7 (2)	---	---
	FORGING		
CONDITION/HT	L-T	T-L	S-L
1650F 4.5 HR, AC,AGED 900F 6 HR	100.3 ± 0.6 (3)	---	---

TABLE 6.18.2.1

ALLOY STEEL   18NI(200)(MAR) K(IC)

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	K(IC) STAN DEV	DATE	REFER
1650F 4.5 HR, AC, AGED 1000F 6 HR	P	4.25	R.T.	L-T	211.0	4.700	2.400	CT	2.400	0.60	103.00			1972	83834 (1)
		4.25			211.0	6.310	3.900	CT	3.220	0.60	103.00			1972	83834 (1)
		4.25			211.0	7.900	3.900	NB	3.930	0.57	101.00	102.3/	1.2	1972	83834 (1)
1650F 4.5 HR, AC, AGED 950F 24 HR	P	4.25	R.T.	L-T	216.0	7.870	3.900	NB	3.930	0.54	100.00			1972	83834 (1)
		4.25			216.0	4.720	2.400	CT	2.390	0.54	100.00			1972	83834 (1)
		4.25			216.0	6.300	3.940	CT	3.940	0.54	98.00	99.3/	1.2	1972	83834 (1)
1650F 4.5 HR, AC, AGED 900F 24 HR	P	4.25	R.T.	L-T	219.0	4.730	2.400	CT	2.390	0.48	96.00			1972	83834 (1)
		4.25			219.0	7.890	3.900	NB	3.940	0.49	97.00	96.5/	0.7	1972	83834 (1)
1650F 4.5 HR, AC, AGED 900F 6 HR	F	3.00	R.T.	L-T	210.0	6.300	3.900	CT	3.180	0.57	100.00			1972	83834 (1)
		3.00			210.0	4.700	2.400	CT	2.360	0.58	101.00			1972	83834 (1)
		3.00			224.0	7.900	3.900	CT	3.880	0.57	100.00	100.3/	0.6	1972	83834 (1)
1650F 4.5 HR, AC, AGED 850F 24 HR	F	3.00	R.T.	L-T	224.0	6.300	3.900	CT	3.160	0.33	81.00			1966	76411 (1)

NOTES
(1) VACUUM ARC REMELTED

6.18-2

TABLE 6.18.3.1

ALLOY STEEL   18NI(200)(MAR) K(1SCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN (*=SQ)	CRACK LENGTH (IN)	K(Q) (KSI*SQRT IN) ^	K(1SCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
	P	0.50	R.T.	L-T	207.0	UNSYMMETRICAL DIMETYL HYDRZINE	3.500	0.500	TDCB	----	110.00	110.00*	----	> 47500	----	80667
TYS=215KSI	P	1.00	R.T.	----	215.0	3.5 PCT NACL	----	1.000	CANT*	----	125.00	70.00	----	----	1972	83613
WELD CENTER LINE	P	----	R.T.	L-S	215.0	3.5 PCT NACL	----	----	CANT	----	115.00	70.00	----	19000	1967	70887
1500F 1HR AC 900F 3HR	P	1.00	R.T.	T-S	219.0	3.5 PCT NACL	----	----	CANT	----	----	39.00	----	> 20000	1971	80824
		1.00			219.0		----	----	CANT	----	----	94.00*	----	> 60000	1971	81004
1650F 900F 3HR AC	P	1.00	R.T.	----	197.0	3.5 PCT NACL	2.500	0.500	CANT*	----	231.00	104.00*	----	----	1970	84342
1675F 2HR AC 500F.15MIN 850F 1HR COOL 250F/MIN	P	----	R.T.	T-S	197.5	3.5 PCT NACL	0.938	0.750	CANT*	0.250	144.00	78.00	----	> 30000	1967	69162
1675F 2HR AC 500F 0.25HR 850F AIR COOL 250F/MIN	P	0.94	R.T.	T-S	192.6	3.5 PCT NACL	0.938	0.750	CANT*	0.250	146.00	48.00	----	> 39000	1967	69162

*NOTE DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(K1SCC/TYS)SQUARED

TABLE 6.19.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 18NI(250)(MAR) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI $\sqrt{IN}$) DEVIATION		

PLATE

CONDITION/HT	L-T	T-L	B-L
1500F AC, 850F 6 HR	76.0 ± 1.9 (5)	---	---
1500F AC, 900F 24 HR	80.7 ± 1.2 (6)	---	---
1500F AC, 950F 6 HR	84.0 ± 2.6 (6)	---	---
1500F, AC, 900F 6 HR	82.3 ± 3.2 (6)	---	---

BILLET

CONDITION/HT	L-T	T-L	B-L
1500F 1HR, AC, AGED 900F 3HR, AC	74.3 ± 4.2 (7)	64.1 ± 4.4 (6)	---

TABLE 6.19.2.1

ALLOY STEEL   18NI(250)(MAR) K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1500F AC, 850F 6 HR	P	4.25	R.T.	L-T	253.0	3.750	1.800	NB	1.800	0.22	73.00		1972	83834
		4.25			253.0	3.000	1.800	CT	1.800	0.22	76.00		1972	83834
		4.25			253.0	3.000	1.800	CT	1.800	0.24	78.00		1972	83834
		4.25			253.0	3.000	1.800	CT	1.800	0.23	77.00		1972	83834
		4.25			253.0	3.750	1.800	NB	1.800	0.22	76.00	76.0/ 1.9	1972	83834
1500F AC, 900F 24 HR	P	2.00	R.T.	L-T	259.0	3.000	1.800	CT	1.800	0.24	81.00		1968	73612
		2.00			259.0	3.000	1.800	CT	1.800	0.25	82.00		1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.24	80.00		1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.25	82.00		1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.23	77.00		1968	73612
		2.00			259.0	3.000	1.800	CT	1.800	0.24	80.00	80.7/ 1.2	1968	73612
1500F AC, 950F 4 HR	P	2.00	R.T.	L-T	252.0	3.750	1.800	NB	1.800	0.32	89.00		1968	73612
		2.00			252.0	3.000	1.800	CT	1.800	0.28	84.00		1968	73612
		2.00			252.0	3.000	1.800	CT	1.800	0.27	83.00		1968	73612
		2.00			252.0	3.000	1.800	CT	1.800	0.26	82.00		1968	73612
		2.00			252.0	3.750	1.800	NB	1.800	0.26	82.00		1968	73612
		2.00			252.0	3.750	1.600	CT	1.600	0.28	84.00	84.0/ 2.6	1968	73612
1500F 1HR, AC, AGED 900F 3HR, AC	RT	12.00	R.T.	L-T	231.0	2.000	1.020	NB	---	0.26	74.90		1974	90981 (1)
		12.00			231.0	2.000	1.020	NB	---	0.24	70.90		1974	90981 (1)
		12.00			233.0	1.000	0.500	CT	---	0.25	73.40		1974	90981 (1)
		1.00			233.0	2.000	1.020	NB	---	0.24	72.20		1974	90981 (1)
		12.00			233.0	2.000	1.020	NB	---	0.22	69.60		1974	90981 (1)
		12.00			233.0	1.000	0.500	CT	---	0.27	77.20		1974	90981 (1)
		12.00			233.0	1.000	0.500	CT	---	0.31	81.80	74.3/ 4.2	1974	90981 (1)
1500F 1HR, AC, AGED 900F 3HR, AC	RT	12.00	R.T.	T-L	232.0	2.000	1.020	NB	---	0.22	67.10		1974	90981 (1)
		12.00			232.0	1.000	0.500	CT	---	0.20	65.00		1974	90981 (1)
		12.00			232.0	1.000	0.500	CT	---	0.22	69.20		1974	90981 (1)
		12.00			232.0	2.000	1.020	NB	---	0.16	57.00		1974	90981 (1)
		12.00			232.0	2.000	1.020	NB	---	0.17	61.00		1974	90981 (1)

NOTES
(1) COMPOSITION(WT PER CENT) 0.013C, 0.007MN, 0.007P, 0.0075I, 18.6NI, 0.10CR, 4.75MOO, 0.6 41TI, 0.11AL.

TABLE 6.19.2.1 (Con't)

ALLOY STEEL   18NI(250)(MAR) K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	STAN DEV	DATE	REFER
1500F 1HR. AC, BT AGED 900F 3HR. AC	P	12.00	R.T.	T-L	232.0	1.000	0.500	CT	---	0.17	61.20	64.1/	4.4	1974	90981 (1)
1500F. AC. 900F 6 HR	P	2.00	R.T.	L-T	259.0	3.000	1.800	CT	1.800	0.23	79.00			1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.24	81.00			1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.26	84.00			1968	73612
		2.00			259.0	3.000	1.800	CT	1.800	0.24	81.00			1968	73612
		2.00			259.0	3.000	1.800	CT	1.800	0.24	81.00			1968	73612
		2.00			259.0	3.750	1.800	NB	1.800	0.29	88.00	82.3/	3.2	1968	73612

NOTES
(1) COMPOSITION(WT PERCENT) 0.014C, 0.087MN, 0.006P, 0.07SI, 18.6NI, 0.10CR, 4.75MOD, 0.41TI, 0.11AL
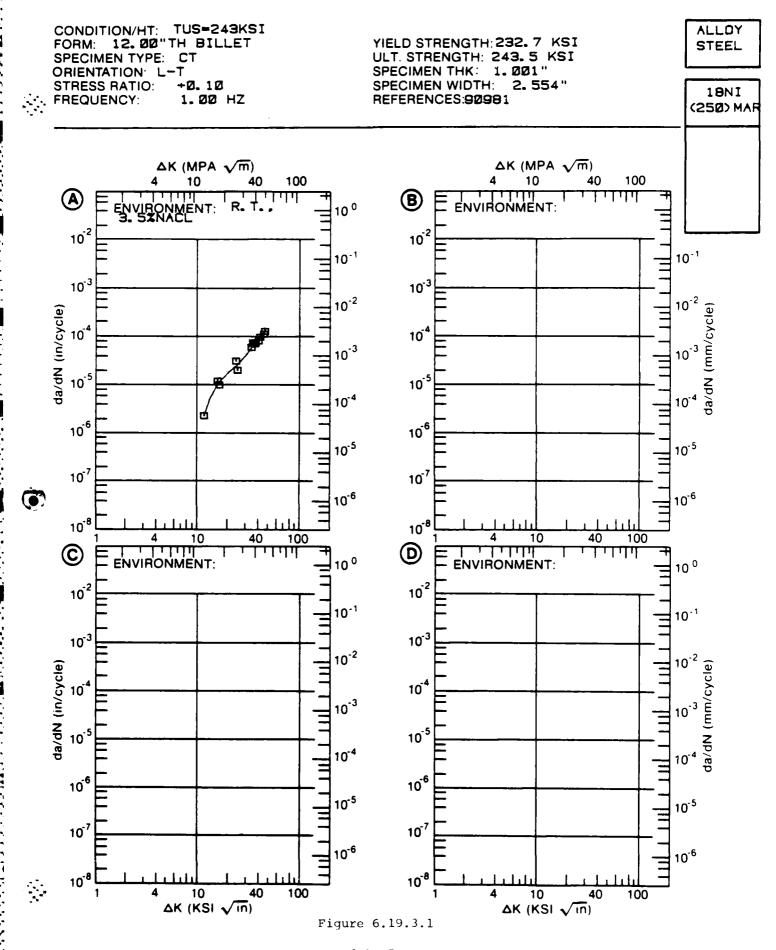
TABLE 6.19.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(250)MAR
CONDITION: TUS=243KSI

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R.T. 3.5%NACL			
DELTA K MIN A: 11.39	:	2.23			
DELTA K MIN B:	:				
DELTA K MIN C:	:				
DELTA K MIN D:	:				
13.00	:	5.05			
16.00	:	11.1			
20.00	:	18.0			
25.00	:	27.5			
30.00	:	42.7			
35.00	:	66.9			
40.00	:	94.2			
DELTA K MAX A: 45.03	:	113.			
DELTA K MAX B:	:				
DELTA K MAX C:	:				
DELTA K MAX D:	:				

ROOT MEAN SQUARE PERCENT ERROR   12.81

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
0.0-0.5		
0.5-0.8		
0.8-1.25		
1.25-2.0	1	
>2.0		

CONDITION/HT: TUS=243KSI
FORM: 12.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.10
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 232.7 KSI
ULT. STRENGTH: 243.5 KSI
SPECIMEN THK: 1.001"
SPECIMEN WIDTH: 2.554"
REFERENCES: 90981

ALLOY
STEEL

18NI
(250) MAR

Figure 6.19.3.1

6.19-5

TABLE 6.19.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
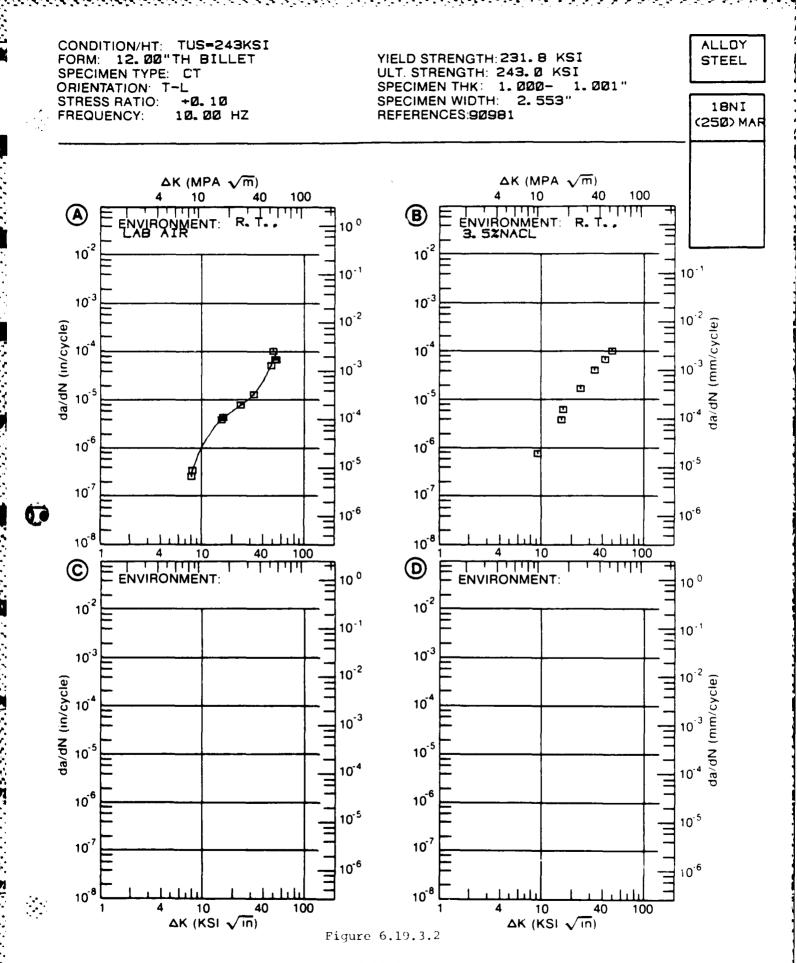
DATA ASSOCIATED WITH FIGURE 6.19.3.2 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(250)MAR
CONDITION: TUS=243KSI

DELTA K		DA/DN (10**-6 IN./CYCLE)			
(KSI*IN**1/2)		A	B	C	D
		E= R.T. LAB AIR	E= R.T. 3.5%NACL		
DELTA K MIN	A: 7.69	.290			
	B:				
	C:				
	D:				
	8.00	.373			
	9.00	.716			
	10.00	1.16			
	13.00	2.73			
	16.00	4.21			
	20.00	5.91			
	25.00	8.16			
	30.00	11.4			
	35.00	16.7			
	40.00	25.7			
	50.00	71.0			
DELTA K MAX	A: 52.78	97.0			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	121.19	0.00

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
0.0-0.5		
0.5-0.8		
0.8-1.25		
1.25-2.0		
>2.0	1	

CONDITION/HT: TUS-243KSI
FORM: 12.00"TH BILLET
SPECIMEN TYPE: CT
ORIENTATION: T-L
STRESS RATIO: +0.10
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 231.8 KSI
ULT. STRENGTH: 243.0 KSI
SPECIMEN THK: 1.000- 1.001"
SPECIMEN WIDTH: 2.553"
REFERENCES: 90981

ALLOY
STEEL

18NI
(250) MAR

Figure 6.19.3.2

TABLE 6.19.3.3

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
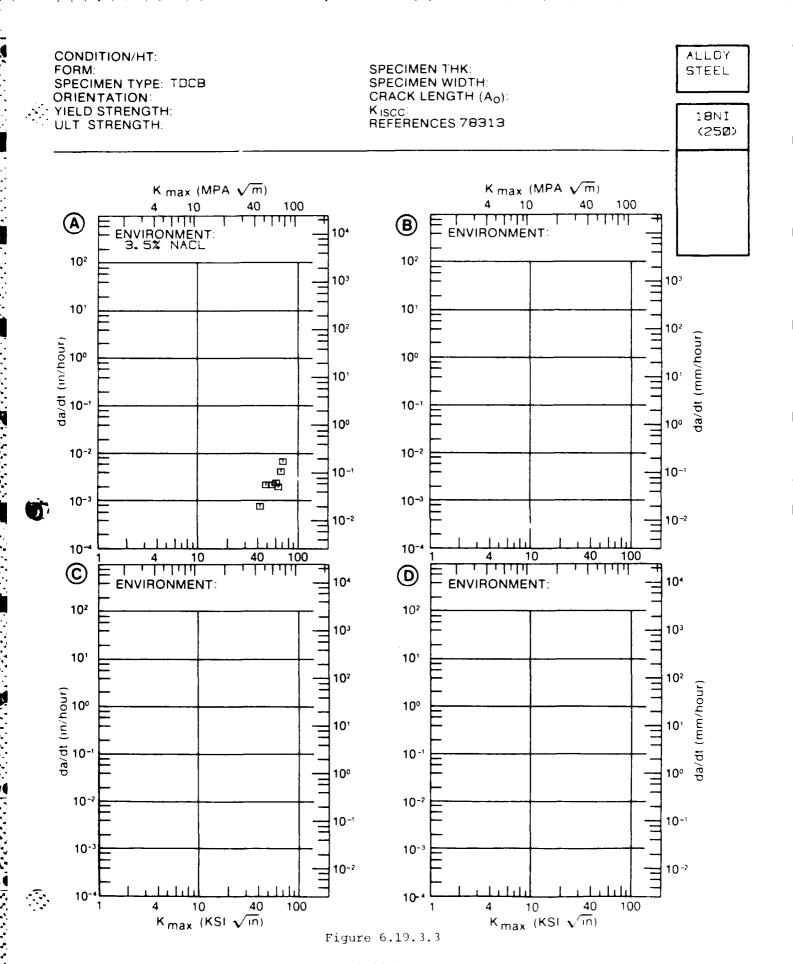
DATA ASSOCIATED WITH FIGURE 6.19.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(250)
CONDITION:

K MAX (KSI*IN**1/2)	:	DA/DT (10**-3 IN/HOUR)			
	:	A	B	C	D
	:	E=			
	:	3.5% NACL			
A:	:				
K MAX B:	:				
MIN C:	:				
D:	:				
200.00	:				
A:	:				
K MAX B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   0.00
PERCENT ERROR

CONDITION/HT:
FORM:
SPECIMEN TYPE: TDCB
ORIENTATION:
YIELD STRENGTH:
ULT STRENGTH:

SPECIMEN THK:
SPECIMEN WIDTH:
CRACK LENGTH (A_O):
K_{ISCC}:
REFERENCES: 78313

ALLOY STEEL

18NI (250)

Figure 6.19.3.3

6.19-9

TABLE 6.19.3.4

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.19.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(250)
CONDITION:

K MAX (KSI*IN**1/2)			DA/DT (10**-3 IN/HOUR)			
			A	B	C	D
			E= DEHUMIDIFIED HYDROGEN	E= HYDROGEN		
K MAX MIN	A:	18.00	1494.			
	B:	23.10		1403.		
	C:					
	D:					
		20.00	4145.			
		25.00	8724.	2376.		
		30.00		5529.		
		35.00		8306.		
		40.00		10206.		
		50.00		12754.		
K MAX MAX	A:	29.20	11124.			
	B:	52.70		13502.		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			9.07	2.81		

CONDITION/HT:
FORM: 0.3"TH PLATE
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 246.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH   2.750"
CRACK LENGTH (A_0):
K_{iSCC}:
REFERENCES 70887, 84310

ALLOY
STEEL

18NI
(250)

A. ENVIRONMENT: DEHUMIDIFIED HYDROGEN
B. ENVIRONMENT: HYDROGEN
C. ENVIRONMENT:
D. ENVIRONMENT:
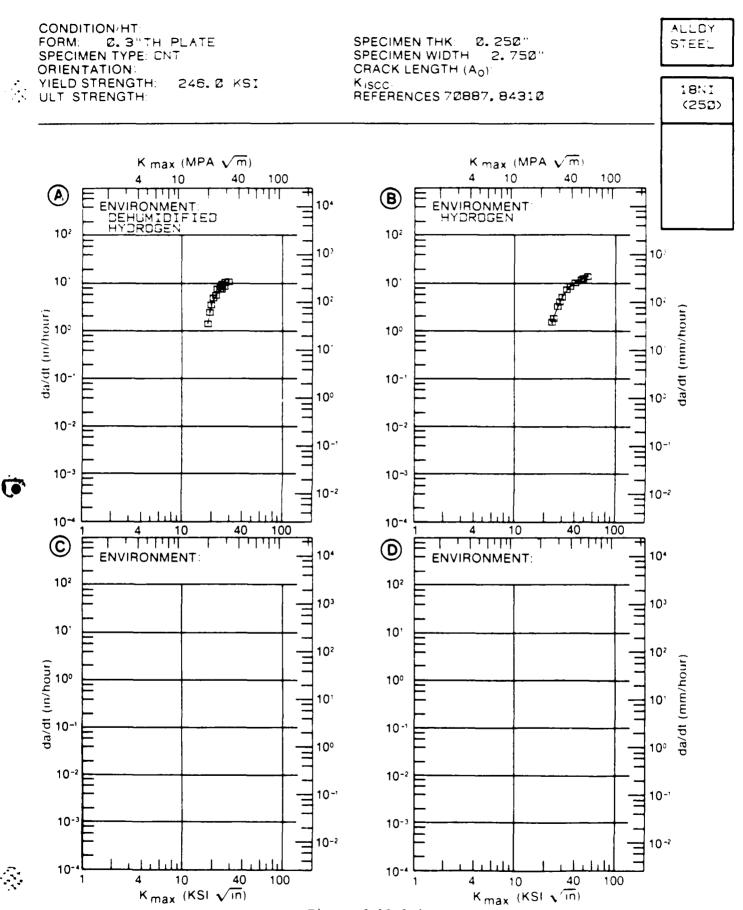
Figure 6.19.3.4

TABLE 6.19.3.5

ALLOY STEEL   18NI(250)(MAR) K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR DTR	YIELD BTR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (s=SO)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) (KSI*SQRT IN)	MEAN STAN DEV	TEST TIME (MIN)	DATE REFER
-------	P	---	R.T.	---	259.0	SYNTH SEAWATER	---	---	---	---	---	36.50		---	1969 74232
		1.00		---	252.0		1.000	1.000 CANT*		---	72.60	49.00		> 30000	1966 65166
		1.25		---	259.0		0.500	1.000 CANT*		0.170	68.00	21.00		> 60000	1968 73827
		1.25		---	259.0		1.000	1.000 CANT*		0.350	78.00	37.00		> 60000	1968 73827
		1.25		---	259.0		3.000	1.000 CANT*		1.050	93.00	35.00		> 60000	1968 73827
		1.25		---	259.0		5.000	1.000 CANT*		1.750	95.00	38.00	36.1/ 8.9	> 60000	1968 73827
AGE 900F 3HR	P	0.48	R.T.	L-T	249.0	3.5 PCT NACL	1.500	0.480 NB		---	92.00	45.00		---	1971 84351
AGED 900F 3HR AC	P	0.50	R.T.	L-S	---	3.5 PCT NACL	0.482	0.375 CANT		---	---	31.00		> 5000	1971 80824
		0.50		---			0.500	0.375 CANT*		---	---	50.00	40.5/ 13.4	7000	1971 80824
TYS=250KSI	P	1.00	R.T.	---	250.0	3.5 PCT NACL	---	1.000 CANT*		---	70.00	50.00		---	1972 63613
TYS=260KSI	P	1.00	R.T.	---	260.0	3.5 PCT NACL	---	1.000 CANT*		---	95.00	70.00		---	1972 83613
1650F 1.25HR WQ.1525F 1.25HR WQ.900F 3HR AC	P	1.25	R.T.	---	259.0	SYNTH SEAWATER	1.000	1.000 CANT*		---	78.00	37.00		---	1970 78065
		1.25		---	259.0		3.000	1.000 CANT*		---	93.00	35.00	36.0/ 1.4	---	1970 78065
1650F 1.25HR WQ.1525F 1.25HR WQ 900F 3HR AC	P	1.25	R.T.	---	259.0	SYNTH SEAWATER	5.000	1.000 CANT*		---	95.00	38.00		---	1970 78065
900F 2HR AC	S	0.68	R.T.	---	228.0	DIST. WATER	2.000	0.050 CNT		---	---	110.00*		> 30000	1968 72283

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.19.3.5 (Con't)

ALLOY STEEL   18NI(250)(MAR) K(ISCC)

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
900F 2HR AC	S	0.08	R.T.	---	228.0	3.5 PCT NACL	2.000	0.030	CNT		----	110.00*	-----	-----	20000	1968	72283

*NOTE--DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.20.3.1

ALLOY STEEL 18NI(280)(MAR) K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC ORR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1500F 1HR AC 900F 3HR	P	---	R T	---	277.0	3.5 PCT NACL	0.750	0.750	CANT	---	60.00	14.00		14400	1971	82164

TABLE 6.21.1.1

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 18NI(300)MAR

ENVIRONMENT H H A
AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-I

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)):	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
----	FORGING	0.05	2.00					22.2	
	FORGING	0.67	2.00			1.51	9.38		

TABLE 6.21.2.1

ALLOY STEEL   18NI(300)(MAR) K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
1700F 1HR.AC, 1500F 1 HR.AC, 900F 6 HR	F	10.00	-65	L-R	----	1.000	0.500	NB	0.500	----	54.00		1970	78425
1700F 1HR.AC, 1500F 1 HR.AC, 900F 6 HR	F	10.00 10.00	R.T.	L-R	280.0 300.0	1.000 1.000	0.500 0.500	NB NB	0.500 0.500	0.16 0.11	71.20 64.20	67.7/ 4.9	1970 1970	78425 78425
1700F 1HR.AC, 1500F 1 HR.AC, 900F 6 HR	F	10.00 10.00	R.T.	R-C	280.0 299.0	1.000 1.000	0.500 0.500	NB NB	0.500 0.500	0.18 0.11	75.50 62.50	67.0/ 9.2	1970 1970	78425 78425
900 F AGED	P	1.00	R T	L-T	276.0	0.800	0.400	CT	0.400	----	----	----	1971	86582 (1)

NOTES
(1) COMPOSITION(WT PERCENT) 0.017C,0.05MN,0.004P,0.007S,0.09SI,18.8NI,4.75MO,7.2CB,0.58TI,0.13AL

TABLE 6.21.2.2

ALLOY STEEL   18NI(300)MAR   K(C)

BUCKLING OF CRACK EDGES NOT RESTRAINED

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	--SPECIMEN-- WIDTH (IN) W	THICK (IN) B	CRACK LENGTH INIT (IN) 2A(0)	FINAL (IN) 2A(F)	GROSS STRESS ONSET (KSI) S(0)	MAX (KSI) S(MAX)	K(APP) (KSI*SQRT IN)	K(APP) MEAN DEV (KSI*SQRT IN) STAN	K(C) (KSI*SQRT IN)	K(C) MEAN DEV (KSI*SQRT IN) STAN	DATE	REFER
S	0.03	-423	L-T	386.0	4.000	0.026	1.250	1.290	---	63.80	95.20		97.12		1964	60578
	0.03			386.0	4.010	0.029	1.250	1.400	---	56.50	84.28		90.70		1964	60578
	0.03			386.0	4.010	0.028	1.230	1.230	---	55.80	82.39		82.39		1964	60578
	0.03			386.0	4.010	0.027	1.250	1.250	---	55.00	82.04		82.04		1964	60578
	0.03			386.0	4.020	0.028	1.170	1.170	---	55.80	79.86	84.8/ 6.0	79.86	86.4/ 7.3	1964	60578
S	0.03	-320	L-T	336.0	2.020	0.025	0.590	0.590	---	150.00	152.50		152.50		1964	60578
	0.03			336.0	2.020	0.025	0.590	0.590	---	141.00	143.35		143.35		1964	60578
	0.03			336.0	2.020	0.025	0.590	0.590	---	141.00	143.35		143.35		1964	60578
	0.03			336.0	2.020	0.025	0.580	0.580	---	131.00	131.80		131.80		1964	60578
	0.03			336.0	2.020	0.025	0.600	0.600	---	138.00	141.76	142.6/ 7.4	141.76	142.6/ 7.4	1964	60578
S	0.03	-320	L-T	336.0	3.950	0.026	1.230	1.230	---	76.50	113.18		113.18		1964	60578
	0.03			336.0	4.010	0.027	1.240	1.250	---	89.50	132.83		133.50		1964	60578
	0.03			336.0	4.020	0.026	1.240	1.240	---	88.00	130.56		130.56		1964	60578
	0.03			336.0	4.020	0.027	1.240	1.240	---	81.90	121.51		121.51		1964	60578
	0.03			336.0	4.020	0.027	1.240	1.240	---	82.50	122.40	124.1/ 7.9	122.40	124.2/ 8.0	1964	60578
S	0.03	R.T.	L-T	277.0	2.010	0.026	0.580	0.580	---	125.00	125.83		125.83		1964	60578
	0.03			277.0	2.020	0.025	0.580	0.580	---	130.00	130.80		130.80		1964	60578
	0.03			277.0	2.020	0.025	0.580	0.580	---	133.00	133.81		133.81		1964	60578
	0.03			277.0	2.020	0.025	0.550	0.550	---	136.00	132.52		132.52		1964	60578
	0.03			277.0	2.020	0.026	0.580	0.600	---	134.00	134.82	131.6/ 3.5	137.65	132.1/ 4.3	1964	60578
S	0.03	R.T.	L-T	277.0	4.000	0.028	1.240	1.240	---	83.80	124.41		124.41		1964	60578
	0.03			277.0	4.000	0.028	1.240	1.240	---	89.20	132.42		132.42		1964	60578
	0.03			277.0	4.000	0.028	1.240	1.240	---	87.40	129.75		129.75		1964	60578
	0.03			277.0	4.000	0.028	1.240	1.260	---	83.00	123.22		124.47		1964	60578
	0.03			277.0	4.000	0.029	1.230	1.240	---	88.50	130.72	128.1/ 4.1	131.39	128.5/ 3.8	1964	60578
S	0.03	R.T.	L-T	277.0	17.700	0.025	5.490	5.490	---	34.70	108.40		108.40		1964	60578
S	0.03	R.T.	L-T	277.0	18.060	0.025	5.500	5.500	---	33.10	103.14		103.26		1964	60578
	0.03			277.0	18.100	0.022	5.470	5.470	---	33.70	104.74		104.74		1964	60578
	0.03			277.0	18.100	0.025	5.480	5.480	---	39.50	122.91	110 3/11.0	122.91	110 3/10 9	1964	60578

TABLE 6.21.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.1 INDICATING EFFECT
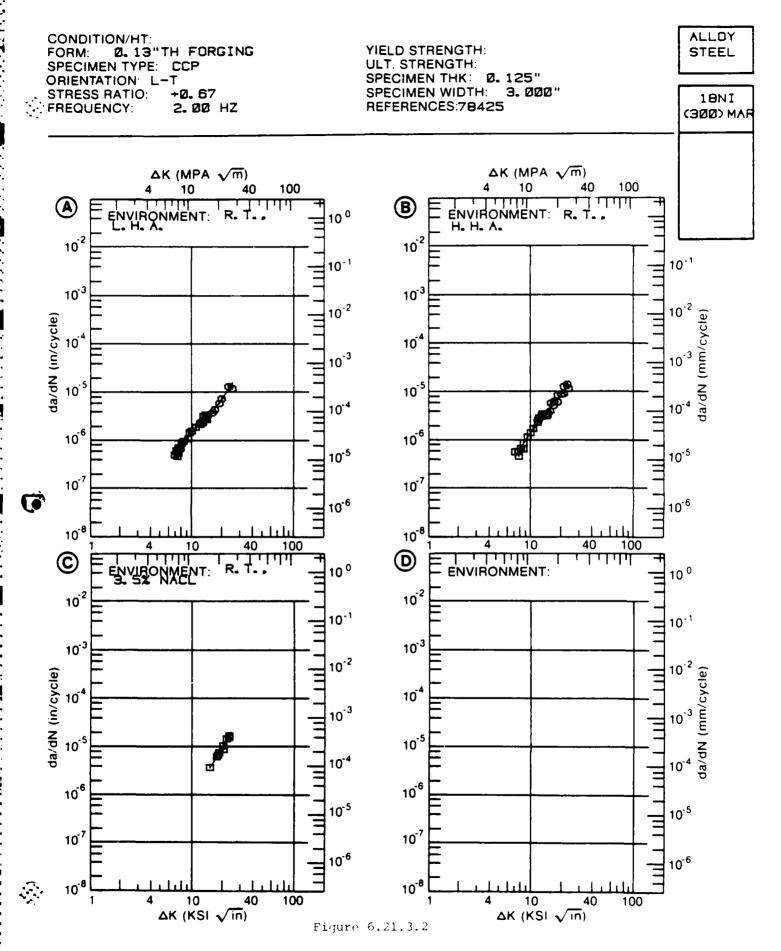
OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(300)MAR
CONDITION:

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:	E= R. T.			
	: H. H. A.				
DELTA K MIN A: 20.16	:	2.64			
B:	:				
C:	:				
D:	:				
25.00	:	6.05			
30.00	:	8.81			
35.00	:	11.3			
40.00	:	14.0			
50.00	:	22.2			
60.00	:	39.9			
DELTA K MAX A: 67.79	:	41.0			
B:	:				
C:	:				
D:	:				

ROOT MEAN SQUARE   14.25
 PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 0.13"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.06
FREQUENCY: 2.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 3.000"
REFERENCES:78425

ALLOY
STEEL

18NI
(300) MAR

Figure 6.21.3.1

6.21-5

TABLE 6.21.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.2 INDICATING EFFECT
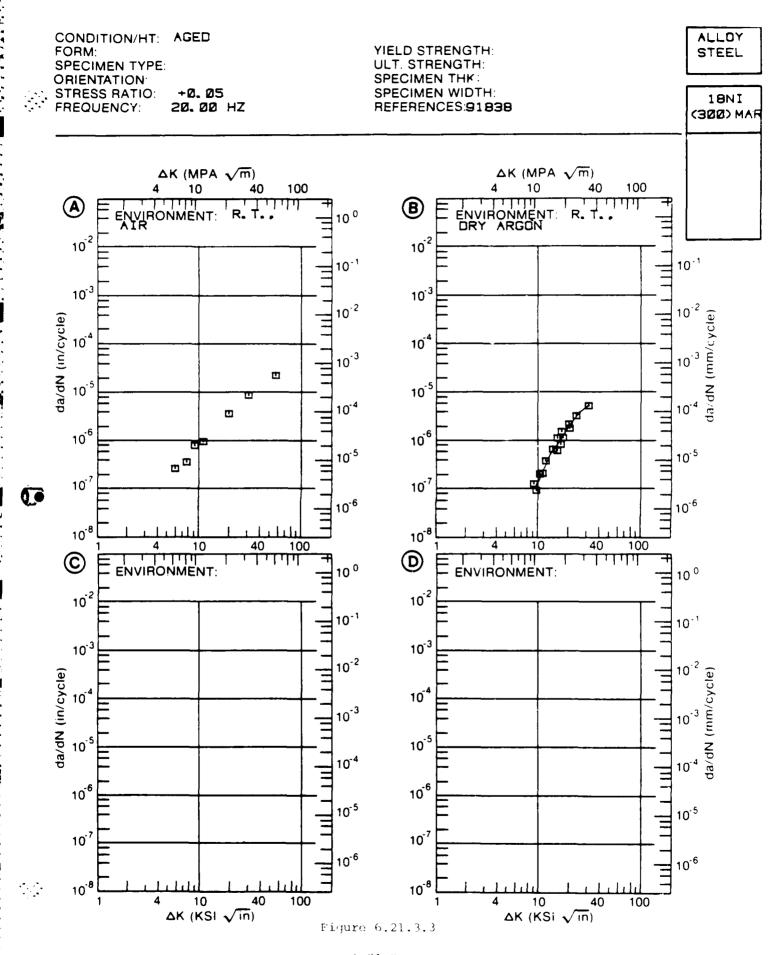
OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(300)MAR
CONDITION:

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. L.H.A.	E= R.T. H.H.A.	E= R.T. 3.5% NACL	
DELTA K MIN	A:	6.67	.474			
	B:	6.85		.435		
	C:	14.61			3.56	
	D:					
		7.00	.561	.472		
		8.00	.847	.753		
		9.00	1.16	1.10		
		10.00	1.49	1.51		
		13.00	2.63	3.11		
		16.00	4.15	5.30	4.82	
		20.00	7.42	9.38	10.2	
DELTA K MAX	A:	24.71	15.1			
	B:	22.98		13.6		
	C:	22.60			16.4	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			11.13	14.20	7.07	

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT:
FORM: 0.13"TH FORGING
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.67
FREQUENCY: 2.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.125"
SPECIMEN WIDTH: 3.000"
REFERENCES:78425

ALLOY
STEEL

18NI
(300) MAR

Figure 6.21.3.2

6.21-7

TABLE 6.21.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.3 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(300)MAR
CONDITION: AGED

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. AIR	E= R.T. DRY ARGON		
DELTA K MIN	A:				
	B: 8.77		.107		
	C:				
	D:				
	9.00		.102		
	10.00		.148		
	13.00		.529		
	16.00		.950		
	20.00		1.97		
	25.00		3.70		
	30.00		4.98		
DELTA K MAX	A:				
	B: 30.62		5.05		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		0.00	19.14		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: AGED
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:91838

ALLOY
STEEL

18NI
(300) MAR

Figure 6.21.3.3

TABLE 6.21.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
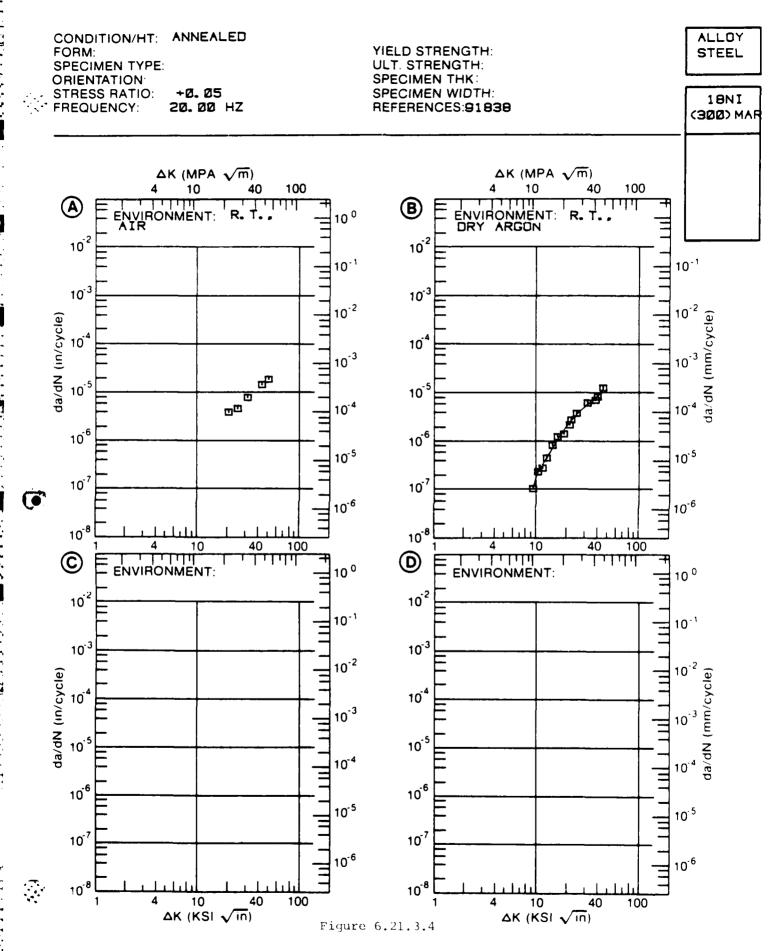
DATA ASSOCIATED WITH FIGURE 6.21.3.4 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(300)MAR
CONDITION: ANNEALED

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. AIR	E= R.T. DRY ARGON		
DELTA K MIN	A:				
	B: 9.05		.101		
	C:				
	D:				
	10.00		.214		
	13.00		.519		
	16.00		1.09		
	20.00		2.14		
	25.00		3.68		
	30.00		5.19		
	35.00		6.72		
	40.00		8.78		
DELTA K MAX	A:				
	B: 44.46		11.7		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	0.00	10.47		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: ANNEALED
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO: +0.05
FREQUENCY: 20.00 HZ

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:91838

ALLOY
STEEL

18NI
(300) MAR

Figure 6.21.3.4

6.21-11

TABLE 6.21.3.5

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.21.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(300)
CONDITION:

K MAX (KSI*IN**1/2)		DA/DT (10**-3 IN/HOUR)			
		A	B	C	D
		E= HYDROGEN	E= 3.5% NACL		
K MAX MIN	A: 12.60	920.			
	B:				
	C:				
	D:				
	13.00	2465.			
	16.00	13691.			
	20.00	18844.			
K MAX MAX	A: 22.20	21037.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	8.44	0.00			

CONDITION/HT:
FORM:
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 1.500"
CRACK LENGTH (A$_o$):
K$_{ISCC}$:
REFERENCES: 84310, 74719

ALLOY
STEEL

18NI
(300)

Figure 6.21.3.5

6.21-13

TABLE 6.21.3.6

ALLOY STEEL 18NI(300)(MAR) K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
AGE 900F 6HR	F	1.00	R.T.	L-T	302.0	3.5 PCT NACL	1.500	0.480	CANT	----	70.00	7.00			----	1970	78425
AGE 900F 6HR	F	1.00 / 9.00	R.T.	T-L	302.0 / 204.3	3.5 PCT NACL	1.500 / 1.000	0.480 / 0.500	CANT	----	70.00 / 72.40	7.00 / 5.00		6.0/ 1.4	----	1970 / 1972	78425 / 84356
AGE 950F 12HR	F	1.00	R.T.	T-L	302.0	3.5 PCT NACL	1.500	0.480	CANT	----	68.00	6.00			----	1970	78425
CRACK PRESTRESSED TO 50 PCT KIC	F	9.00	R.T.	T-L	284.3	3.5 PCT NACL	1.000	0.500	CANT	----	72.40	5.00			----	1972	84356
CRACK PRESTRESSED TO 25 PCT KIC	F	9.00	R.T.	T-L	284.3	3.5 PCT NACL	1.000	0.500	CANT	----	72.40	5.00			----	1972	84356
CRACK PRESTRESSED TO 80 PCT KIC	F	9.00	R.T.	T-L	284.3	3.5 PCT NACL	1.000	0.500	CANT	----	72.40	10.00			----	1972	84356
1500F 0.5HR AC 700F 3HR	P	0.25 / 0.25	R.T.	L-S	285.8 / 285.8	DIST. WATER	1.000 / 1.000	0.250 / 0.250	CANT* / CANT*	0.200 / 0.200	63.10 / 93.90	60.00 / 36.00		48.0/ 17.0	>10000 / >10000	1965 / 1965	63061 / 63061
1500F 2HR 800F 10HR	B	----	R.T.	L-S	280.0	DIST. WATER	0.625	0.500	CANT*	----	120.00	9.00			>1500	1970	77716
1500F 2HR 800F 10HR	B	----	R.T.	L-S	280.0	1N H2SO4	0.625	0.500	CANT*	----	120.00	10.00			>1500	1970	77716
1500F 2HR 800F 10HR	B	----	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	----	120.00	9.00			>10000	1970	77716
1500F 2HR 800F 10HR	B	----	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	----	120.00	10.00			>8500	1970	77716

TABLE 6.21.3.6 (Con't)

ALLOY STEEL   18NI(300)(MAR)   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1500F 2HR 900F 3 5HR	B	----	R.T.	L-S	280.0	1.5 PCT NA2CR2U7	0.625	0.500	CANT*	----	99.00	12.00	---	---	1970	77716
1500F 2HR 900F 100HR	B	----	R.T.	L-S	280.0	1N H2SO4	0.625	0.500	CANT*	----	70.00	9.00	---	---	1970	77716
1500F 2HR 900F 100HR	B	----	R.T.	L-S	280.0	3% NACL -0.4V TO -1.2V	0.625	0.500	CANT*	----	70.00	9.00	---	---	1970	77716
1500F 2HR 900F 100HR	B	----	R.T.	L-S	280.0	3% NACL 029AT	0.625	0.500	CANT*	----	70.00	10.00	---	10000	1970	77716
1500F 2HR 900F 100HR	B	----	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	----	70.00	15.00	---	> 10000	1970	77716
1500F 2HR 900F 3 5HR	B	----	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	----	99.00	10.00	---	---	1970	77716
1500F 2HR 900F 3 5HR	B	----	R.T.	L-S	280.0	3% NACL PH11	0.625	0.500	CANT*	----	99.00	12.00	---	---	1970	77716
1500F 2HR 900F 5 5HR	B	----	R.T.	L-S	280.0	3% NACL PH3.9	0.625	0.500	CANT*	----	99.00	17.00	---	---	1970	77716
1500F 2HR 900F 100HR	B	----	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	----	70.00	10.00	---	> 8500	1970	77716
1500F 2HR 900F 3 5HR	B	----	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	----	99.00	8.00	---	> 8500	1970	77716
1500F 1500F AGED 900F 6HR	F	2.00	R.T.	T-L	284.0	3.5 PCT NACL	1.000	0.400	CHAR	----	72.40	7.50	---	> 9000	1970	78761
975OF 1HR 1750F 4HR 900F 100HR	B	----	R.T.	L-S	280.0	1N H2SO4	0.625	0.500	CANT*	----	53.00	10.00	---	---	1970	77716

TABLE 6.21.3.6 (Con't)

ALLOY STEEL. 18NI(300)(MAR) K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (#=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
2300F 1HR 1700F 4HR 900F 10HR	B	---	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	---	58.00	14.00		> 2500	1970	77716
2300F 1HR 1700F 4HR 900F 100HR	B	---	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	---	53.00	10.00		> 2500	1970	77716
2300F 1HR 1700F 4HR 900F 3.5HR	B	---	R.T.	L-S	280.0	3% NACL PH1.7	0.625	0.500	CANT*	---	57.00	8.00		> 2500	1970	77716
2300F 1HR 1700F 4HR 900F 10HR	B	---	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	---	58.00	13.00		> 2500	1970	77716
2300F 1HR 1700F 4HR 900F 100HR	B	---	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	---	53.00	9.00		> 2500	1970	77716
2300F 1HR 1700F 4HR 900F 3.5HR	B	---	R.T.	L-S	280.0	3% NACL PH6.3	0.625	0.500	CANT*	---	57.00	9.00		> 2500	1970	77716
900F 3HR 950F 3HR	F	1.00	R.T.	T-L	306.0	3.5 PCT NACL	1.500	0.480	CANT	---	70.00	5.00		---	1970	78425

TABLE 6.22.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.22.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   18NI(350)
CONDITION: AGED 8HR 800F

K MAX $(KSI*IN**1/2)$			DA/DT $(10**-3$ IN/HOUR)			
			A	B	C	D
			E= 3.5% NACL			
K MAX MIN	A:	13.00	392.			
	B:					
	C:					
	D:					
		16.00	930.			
		20.00	1502.			
		25.00	2053.			
		30.00	2898.			
K MAX MAX	A:	32.00	3454.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE   9.79
PERCENT ERROR

CONDITION/HT: AGED 8HR 800F
FORM:
SPECIMEN TYPE: NB
ORIENTATION:
YIELD STRENGTH: 330.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.394"
SPECIMEN WIDTH: 0.394"
CRACK LENGTH (A_O):
K_{ISCC}:
REFERENCES: 74719

ALLOY
STEEL

18NI
(350)

Figure 6.22.3.1
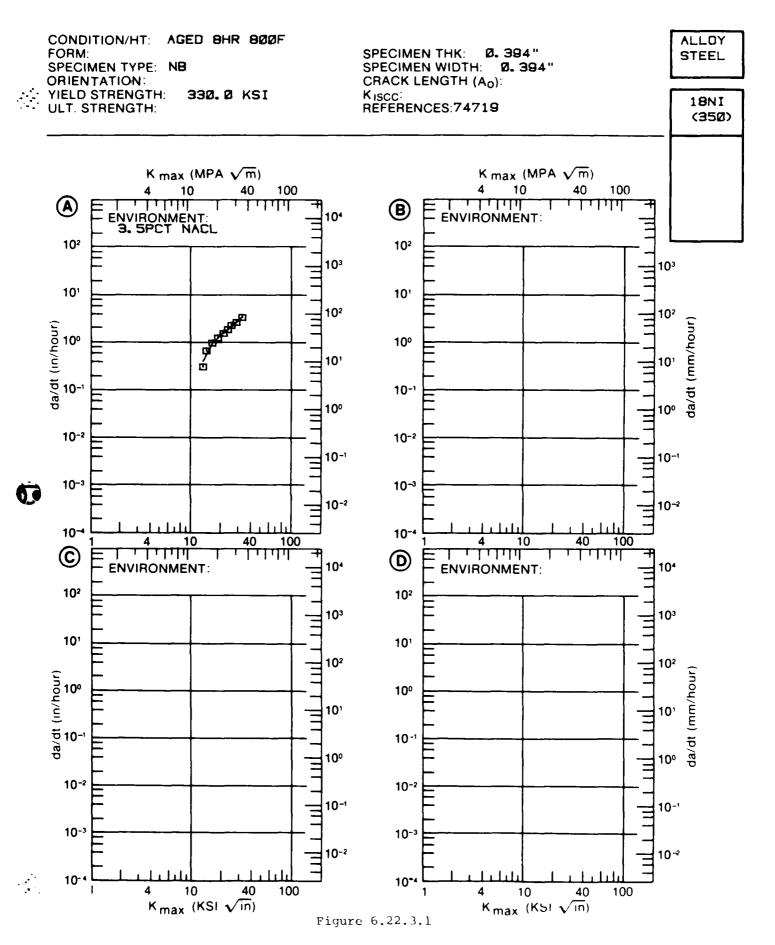
TABLE 6.22.3.2

ALLOY STEEL   18NI(350)(MAR) K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) K(ISCC) (KSI*SQRT IN)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
AGF 800F 8HR	FB	----	R.T.	---	299.0	3.5 PCT NACL	0.394	0.394	CHAR	----	30.00	5.00			1971	84351
AGF 900F 3HR	FB	----	R.T.	---	330.0	3.5 PCT NACL	0.394	0.394	CHAR	----	42.00	10.00			1971	84351
AGF 900F 8HR	FB	----	R.T.	---	335.0	3.5 PCT NACL	0.394	0.394	CHAR	----	36.00	10.00			1971	84351
1500F 1HR 800F 8HR	F	4.00	R.T.	L-S	299.0	3.5 PCT NACL	0.394	0.394	--	----	70.10	5.00		> 3000	1969	75677
1500F 1HR 900F 8HR	F	4.00	R.T.	L-S	325.0	3.5 PCT NACL	0.394	0.394	--	----	35.00	10.00		> 8500	1969	75677
1500F 1HR 950F 3HR	F	4.00	R.T.	L-S	325.0	3.5 PCT NACL	0.394	0.394	--	----	40.00	10.00		> 6300	1969	75677

TABLE 6.23.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 300M AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN)) (NUMBER OF SPECIMENS)		

PLATE

CONDITION/HT	L-T	T-L	S-L
HEAT TREATED TO 54 RC HARDNESS	----	58.6 ± 3.5 (2)	----
1700F 1HR AC, 1600F 1HR DQ, 600F 2HR AC (AMS 6419)	51.8 ± 0.7 (3)	----	----

FORGING

CONDITION/HT	L-T	T-L	S-L
---	52.6 ± 2.3 (4)	52.9 ± 2.0 (4)	----
1600F 1.25 HR, DQ, 600F 2+2HR	54.6 ± 2.5 (4)	50.6 ± 1.7 (2)	54.1 ± 1.1 (4)

BAR

CONDITION/HT	L-T	T-L	S-L
2190F 1HR,FC TO 1600F, HOLD 0.5HR, DQ, 475F 1HR	47.9 ± 3.8 (2)	----	----

TABLE 6.23.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

ENVIRONMENT: L H A AT R T

TFSI CONDITIONS

SPECIMEN ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	10	20	50	100
UTS-280-300KSI	BILLET	-1.00	10.00				3.18	188	
UTS-280-300KSI	BILLET	0.00	10.00				2.96	38.0	
UTS-280-300KSI	BILLET	0.50	10.00			0.65	6.97		
1700F 1.5HRS AC,1600F 1.5HRS OQ,400F 2+2HRS	FORGING	0.30	6.00				4.88		
1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS	FORGING	0.50	6.00			0.90	6.83		
1700F 1.5HRS AC,1600F 1.5HRS OQ,400F 2+2HRS	FORGING	0.08	1.00				3.67		
1700F 1.5HRS AC,1600F 1.5HRS OQ,600F 2+2HRS	FORGING	0.08	6.00			0.65	4.03		

TABLE 6.23.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

ENVIRONMENT LAB AIR AT R T

<u>TEST CONDITIONS</u>

SPECIMEN ORIENTATION I-I

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2	5	10	20	50	100
- - -	FORGING	0 02	0 10-20 00				0 71	3 83	82 7	
TUS-280-300KSI	BAR	-1 00	10 00					3 79	42 4	
TUS=280-300KSI	BAR	0 02	10 00					3 56	47 0	
TUS-280-300KSI	BAR	0 50	10 00				1 02	6 52		

TABLE 6.23.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN ORIENTATION L-T

ENVIRONMENT 3.5% NACL AT RT

CONDITION(/HT)	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2.5	5	10	20	50	100
US 285-300KSI	BILLET	0.00	1.00					4.20	105	
US=280-300KSI	BILLET	0.00	10.00					2.24	100	

6.23-4

TABLE 6.23.1.5

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

ENVIRONMENT ALT IMMERSION IN SEA WATER-IMMERSED
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ. (HZ)	DELTA K LEVELS (KSI SQRT(IN))		FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100
TUS-280-300KSI	BILLET	0.00	1.00				8.04		
TUS=280-300KSI	BILLET	0.00	10.00				2.61		

TABLE 6.23.1.6

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT: ALT IMMERSION IN SEA WATER-1ST HALF DRY CYCLE
AT R.T.

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS: (KSI SQRT(IN))			FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)		
				2.5	5	10	20	50	100
TUS=280-300KSI	BILLET	0.00	1.00				7.06	50.6	
TUS=280 300KSI	BILLET	0.00	10.00				2.17		

TABLE 6.23.1.7

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 300M

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

ENVIRONMENT   ALT IMMERSION IN SEA WATER-2ND HALF DRY CYCLE
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))				FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)			
				2 5	5	10	20	50	100
TUS=280-300KSI	BILLET	0.00	1.00				2.61		
TUS=280-300KSI	BILLET	0.00	10.00				2.05		

6.23-7

TABLE 6.23.2.1

ALLOY STEEL   300M   K(IC)

HEAT TREAT	FORM	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5 (K(IC)/TYS)² (IN)	K(IC) MEAN (KSI-SQRT IN)	STAN DEV	DATE	REFER
	F	RT	L-T	239.0	2.504	1.267	CT	1.293	0.12	53.50		1977	MA005
				239.0	2.507	1.249	CT	1.279	0.13	53.50		1977	MA005
				246.5	2.505	1.251	CT	1.267	0.10	50.00		1977	MA005
				246.5	2.490	1.251	CT	1.286	0.10	50.70	52.6/ 2.3	1977	MA005
	F	RT	T-L	240.0	2.476	1.256	CT	1.271	0.13	55.50		1977	MA005
				240.0	2.512	1.254	CT	1.288	0.12	53.50		1977	MA005
				246.5	2.507	1.247	CT	1.228	0.10	51.70		1977	MA005
				246.5	2.508	1.252	CT	1.296	0.10	50.90	52.9/ 2.0	1977	MA005
HEAT TREATED 10 53 RC MARTENSITE	F	RT	T-L	250.0	0.904	0.447	NB	0.485	0.12	56.10		1971	84029 (1)
				250.0	0.903	0.448	NB	0.473	0.15	61.10	50.6/ 3.5	1971	84029 (1)
1600F 0.5 HR, 50,1000F 0.5-1.0 HR. OQ 80-180F 25 MIN.575F 2+2HR	F	RT	--	245.0	1.505	0.747	CT	0.752	0.10	48.40		1970	84280 (2)
		-65		245.0	1.503	0.750	CT	0.758	0.10	48.00		1970	84280 (2)
				245.0	1.501	0.750	CT	0.734	0.07	41.50	46.0/ 3.9	1970	84280 (2)
1600F 0.5 HR, 50,1000F 0.5-1.0 HR. OQ 80-180F 25 MIN.575F 2+2HR	F	RT	--	231.0	1.497	0.745	CT	0.735	0.14	55.30		1970	84280 (2)
		0		231.0	1.503	0.746	CT	0.742	0.16	58.70		1970	84280 (2)
				231.0	1.501	0.750	CT	0.736	0.15	57.20	57.1/ 1.7	1970	84280 (2)
1600F 0.5 HR, 50,1000F 0.5-1.0 HR. OQ 80-180F 25 MIN.575F 2+2HR	F	RT	--	230.0	1.501	0.749	CT	0.737	0.19	64.30		1970	84280 (2)
				230.0	1.479	0.750	CT	0.735	0.20	64.60		1970	84280 (2)
				230.0	1.504	0.750	CT	0.739	0.20	65.70	64.9/ 0.7	1970	84280 (2)
1600F 0.5 HR, 50,1000F 0.5-1.0 HR. OQ 80-180F 25 MIN.575F 2+2HR	F	RT	200	--	220.0	1.497	0.745	CT	0.734	0.24	68.10	1970	84280 (2)
				220.0	1.500	0.746	CT	0.734	0.24	67.70		1970	84280 (2)
				220.0	1.502	0.749	CT	0.729	0.25	68.90	68.2/ 0.6	1970	84280 (2)

NOTES:
(1) COMPOSITION(WT PERCENT) C 43C.0 65MN.O COMP.O 0065.1 65SI.1 77NI.0 85CR.0 OBV
(2) ORIENTATION L, FORM FLAP TRACK

TABLE 6.23.2.1 (Con't)

						ALLOY STEEL	300M			K(IC)						
CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	STAN DEV	DATE	REFER
1600F 1.25 HR, OQ. 600F 2+2HR	F	3.00	R T	L-T	237.0	1.000	0.249	CT	0.495	0.13	51.50			1973	85836
		3.00			237.0	1.002	0.248	CT	0.502	0.14	53.80			1973	85836
		3.00			237.0	1.002	0.247	CT	0.491	0.15	56.10	54.6/	2.5	1973	85836
		3.00			237.0	1.002	0.247	CT	0.495	0.15	57.10			1973	85836
1600F 1.25 HR, OQ. 600F 2+2HR	F	3.00	R T	T-L	240.0	1.002	0.248	CT	0.507	0.13	51.80			1973	85836
		3.00			240.0	0.987	0.247	CT	0.492	0.12	49.40	50.6/	1.7	1973	85836
1600F 1.25 HR, OQ. 600F 2+2HR	F	3.00	R T	S-L	230.0	1.005	0.248	CT	0.496	0.14	55.10			1973	85836
		3.00			230.0	1.002	0.248	CT	0.497	0.13	52.80			1973	85836
		3.00			230.0	1.004	0.247	CT	0.504	0.14	54.90	54.1/	1.1	1973	85836
		3.00			230.0	1.000	0.248	CT	0.485	0.14	53.60			1973	85836
1600F 1HR,OQ. 475F 1HR	B	0.62	R T	L-T	240.0	2.000	0.600	CT	1.000	0.05	34.80			1973	87241 (1)
1600F 1HR,OQ. 1HR.WQ.475F 1HR	B	0.62	R T	L-T	240.0	2.000	0.600	CT	1.000	0.05	34.30			1973	87241 (1)
1600F 1HR,OQ. 615F 1 HR	D	0.62	R T	L-T	245.0	2.000	0.600	CT	1.000	0.17	64.80			1973	87241 (1)
1600F 1HR,OQ. 575F 1HR	B	0.62	R T	L-T	245.0	2.000	0.600	CT	1.000	0.15	59.40			1973	87241 (1)
1600F 1HR,OQ. 745F 1HR	B	0.62	R T	L-T	245.0	2.000	0.600	CT	1.000	0.15	60.90			1973	87241
1600F,OQ.550F 2+2HR	F	0.56	R T	I-I	235.0	1.500	0.500	NB	---	0.20	66.00			1970	78305 (2)
1675F AC.1575F, OQ.800F 2HR (RC 47.5)	P	1.00	R T	--	220.0	1.988	1.010	CT	1.088	0.12	47.30			1973	85883 (3)

NOTES
(1) COMPOSITION (PERCENT) 0.41C,0.75MN,0.008P,0.0025,1.59SI,1.05NI,0.75CR,0.08V,0.04CU
(2) COLD ROLLED 50% WITH INTERMEDIATE ANNEALS AT 1275F TO GET FINE GRAIN SIZE
(3) COMPOSITION (PERCENT) 0.39C,0.85MN,0.008P,0.0035,1.61SI,1.80NI,0.85CR,0.08V (ESTIMATED TYS)

TABLE 6.23.2.1 (Con't)

ALLOY STEEL 300M K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN / STAN DEV (KSI*SQRT IN)	DATE	REFER
1675F AC,1575F OQ,800F 2HR (RC 47 5)	P	1.00	R.T.	--	220.0 220.0 220.0	1.774 1.998 1.975	1.010 1.010 1.010	CT CT CT	1.068 1.122 1.081	0.13 0.13 0.13	47.80 50.10 47.60	49.2/ 1.3	1973 1973 1973	85883 (1) 85883 (1) 85883 (1)
1675F.AC.1575F OQ,500F 2HR (RC 51 5)	P	1.00 1.00 1.00 1.00	R.T.	--	240.0 240.0 240.0 240.0	2.001 1.996 1.973 2.001	1.010 1.010 1.010 1.010	CT CT CT CT	1.147 1.065 1.054 1.092	0.09 0.12 0.09 0.12	45.90 51.80 46.20 52.60	49.1/ 3.6	1973 1973 1973 1973	85883 (1) 85883 (1) 85883 (1) 85883 (1)
1675F.AC.1575F OQ.1100F 2HR (RC 39)	P	1.00 1.00 1.00 1.00	R.T.	--	200.0 200.0 200.0 200.0	1.996 2.000 1.997 1.909	1.010 1.009 1.012 1.010	CT CT CT CT	1.123 1.103 1.137 1.139	0.43 0.36 0.42 0.45	82.90 76.20 81.50 84.80	81.4/ 3.7	1973 1973 1973 1973	85883 (1) 85883 (1) 85883 (1) 85883 (1)
1700F 1HR AC, 1600F 1HR DQ, 600F 2HR AC (AMS 6419)	P	1.00 1.00 1.00	R T	L-T	236.0 236.0 236.0	0.991 0.973 1.000	0.501 0.502 0.500	NB NB NB	0.485 0.491 0.490	0.12 0.12 0.12	52.00 51.00 52.40	51.8/ 0.7	1974 1974 1974	88136 88136 88136
2150F 1HR,FC TO 1600F,HOLD 0 5HR,OQ,475F 1HR	B	0.62 0.62	R T	L-T	235.0 235.0	2.000 2.000	0.600 0.600	CT CT	1.000 1.000	0.12 0.09	50.60 45.20	47.9/ 3 8	1973 1973	87241 87241
2150F 1HR,FC TO 1600F,HOLD 0 5HR,OQ,615F 1HR	B	0.62	R.T.	L-T	240.0	2.000	0.600	CT	1.000	0.12	52.70		1973	87241
2150F 1HR,FC TO 1600F,HOLD 0 5HR,OQ,745F 1HR	B	0.62	R.T.	L-T	240.0	2.000	0.600	CT	1.000	0.18	63.50		1973	87241

NOTES
(1) COMPOSITION(WT PERCENT) 0 37C,0 85MN,0 COBP,0 6055,1 6151,1 AONI,0 85CR,0 OBV (ESTIMATED TYS)

TABLE 6.23.2.1 (Con't)

ALLOY STEEL   300M   K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
2190F 1HR,DQ, 400F 1HR	B	0.62	R.T.	L-T	219.0	2.000	0.600	CT	1.000	0.29	75.00		1973	87241
2190F 1HR,DQ, 475F 1HR	B	0.62	R.T.	L-T	230.0	2.000	0.600	CT	1.000	0.23	69.20		1973	87241
2190F 1HR,DQ, 475F 1HR,WQ,475F 1HR	B	0.62	R.T.	L-T	232.0	2.000	0.600	CT	1.000	0.24	71.80		1973	87241
2190F 1HR,DQ, 615F 1HR	B	0.62	R.T.	L-T	236.0	2.000	0.600	CT	1.000	0.26	75.50		1973	87241
2190F 1HR,DQ, 745F 1HR	B	0.62	R.T.	L-T	240.0	2.000	0.600	CT	1.000	0.24	74.70		1973	87241

TABLE 6.23.2.2

ALLOY STEEL   300M   K(C)

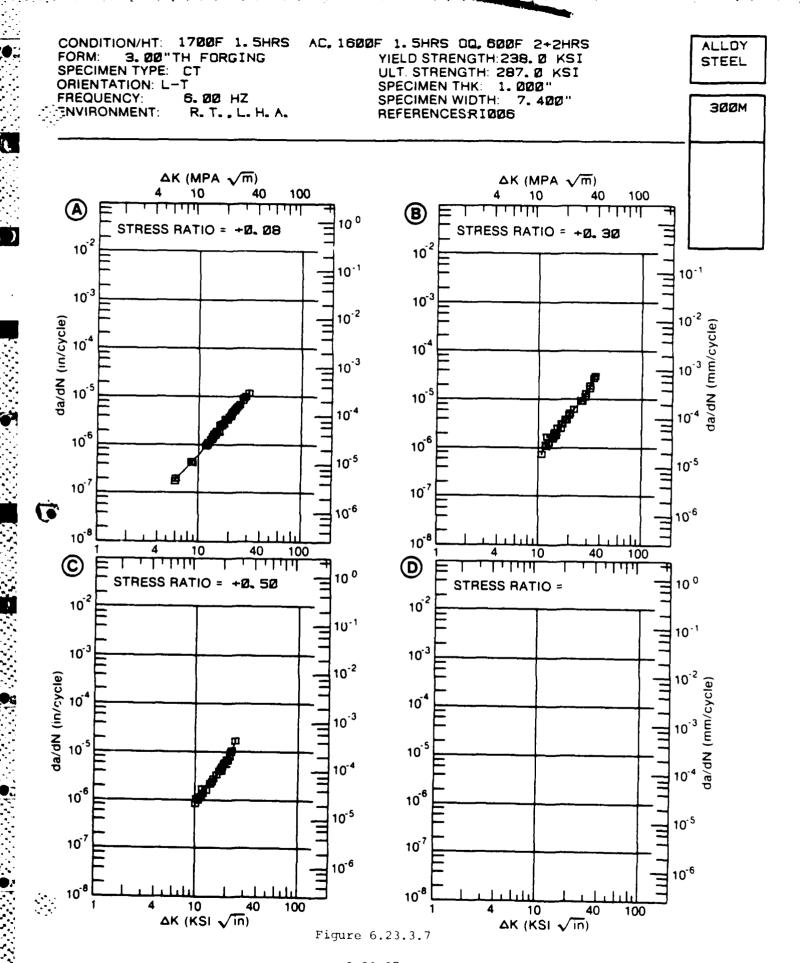| PRODUCT FORM THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	CRACK LENGTH INIT (IN) 2A(0)	CRACK LENGTH FINAL (IN) 2A(F)	GROSS STRESS MAX (KSI) S(MAX)	GROSS STRESS ONSET (KSI) S(0)	K(APP) (KSI*SQRT IN)	K(APP) MEAN DEV	K(C) (KSI*SQRT IN)	K(C) MEAN STAN DEV (KSI*SQRT IN)	DATE	REFER
AMS 6434 S UTS=280-300KSI															
BUCKLING OF CRACK EDGES RESTRAINED															
0.13	R.T.	L-T	239.0	5.000	0.119	1.880	---	71.10	---	134.06		----	---- / ---	1968	73988
0.13			239.0	5.000	0.123	2.530	---	63.30	---	150.78		----	---- / ---	1968	73988
0.13			239.0	5.000	0.130	1.170	---	98.60	---	138.37	141.1/ 8.7	----	---- / ---	1968	73988
AMS 6434 P UTS=220-240KSI															
BUCKLING OF CRACK EDGES NOT RESTRAINED															
0.38	R.T.	L-T	209.0	5.000	0.374	1.300	---	50.40	---	75.18		----	---- / ---	1968	73988
0.38			209.0	5.000	0.370	1.850	---	35.90	---	66.94		----	---- / ---	1968	73988
0.38			209.0	5.000	0.370	1.790	---	36.10	---	64.82		----	---- / ---	1968	73988
0.38			209.0	5.000	0.372	2.440	---	36.10	---	83.27		----	---- / ---	1968	73988
0.38			209.0	5.000	0.372	2.500	---	30.30	---	71.41		----	---- / ---	1968	73988
0.38			209.0	5.000	0.371	1.320	---	43.20	---	65.02	71.1/ 7.2	----	---- / ---	1968	73988
AMS 6434 P UTS=260-280KSI															
BUCKLING OF CRACK EDGES NOT RESTRAINED															
0.38	R.T.	L-T	234.0	5.000	0.369	2.080	---	33.00	---	66.94		----	---- / ---	1968	73988
0.38			234.0	5.000	0.368	1.710	---	44.30	---	78.33		----	---- / ---	1968	73988
0.38			234.0	5.000	0.371	2.500	---	27.00	---	63.63		----	---- / ---	1968	73988
0.38			234.0	5.000	0.370	1.240	---	52.40	---	76.04		----	---- / ---	1968	73988
0.38			234.0	5.000	0.374	2.540	---	32.80	---	78.41		----	---- / ---	1968	73988
0.38			234.0	5.000	0.372	1.380	---	41.90	---	64.76	71.4/ 7.0	----	---- / ---	1968	73988
AMS 6434 P UTS=280-300KSI															
BUCKLING OF CRACK EDGES NOT RESTRAINED															
0.38	R.T.	L-T	238.0	5.000	0.372	1.900	---	46.40	---	88.14		----	---- / ---	1968	73988
0.38			238.0	5.000	0.372	2.280	---	38.30	---	83.46		----	---- / ---	1968	73988
0.38			238.0	5.000	0.372	1.050	---	61.20	---	80.81	84.1/ 3.7	----	---- / ---	1968	73988

TABLE 6.23.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.1 INDICATING EFFECT

OF ENVIRONMENT

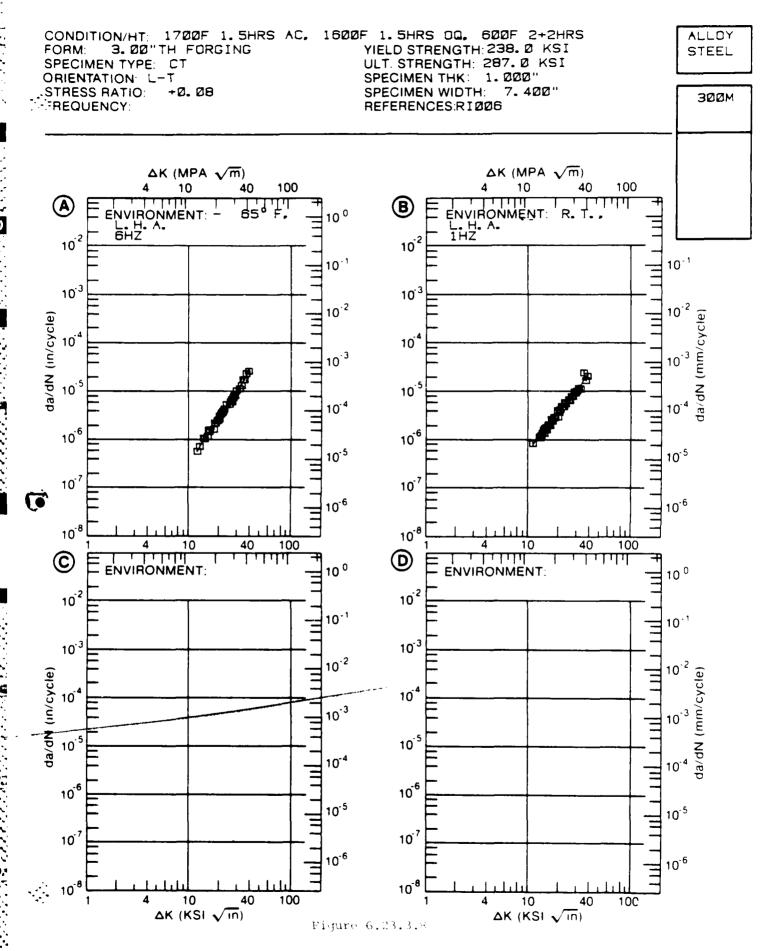MATERIAL ALLOY STEEL   300M
CONDITION

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. LAB AIR	E= R.T. SIM SEA WATER		
DELTA K MIN	A	5.02	.113			
	B	9.06		.488		
	C					
	D					
		6.00	.192			
		7.00	.293			
		8.00	.415			
		9.00	.555			
		10.00	.716	.740		
		13.00	1.33	1.51		
		16.00	2.18	2.17		
		20.00	3.83	3.30		
		25.00	7.04	5.90		
		30.00	12.2	10.8		
		35.00	20.5	20.0		
		40.00	33.3	36.9		
		50.00	82.7	158.		
DELTA K MAX	A	52.48	103.			
	B	51.27		548.		
	C					
	D					
ROOT MEAN SQUARE PERCENT ERROR			23.32	32.26		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 1.25"TH FORGING
SPECIMEN TYPE: WOL
ORIENTATION· L-T
STRESS RATIO: +0.02
FREQUENCY: 0.10- 20.00 HZ

YIELD STRENGTH:239.0- 246.5 KSI
ULT. STRENGTH: 291.0- 297.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:MA005

ALLOY
STEEL

300M

Figure 6.23.3.1

6.23-15

TABLE 6.23.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
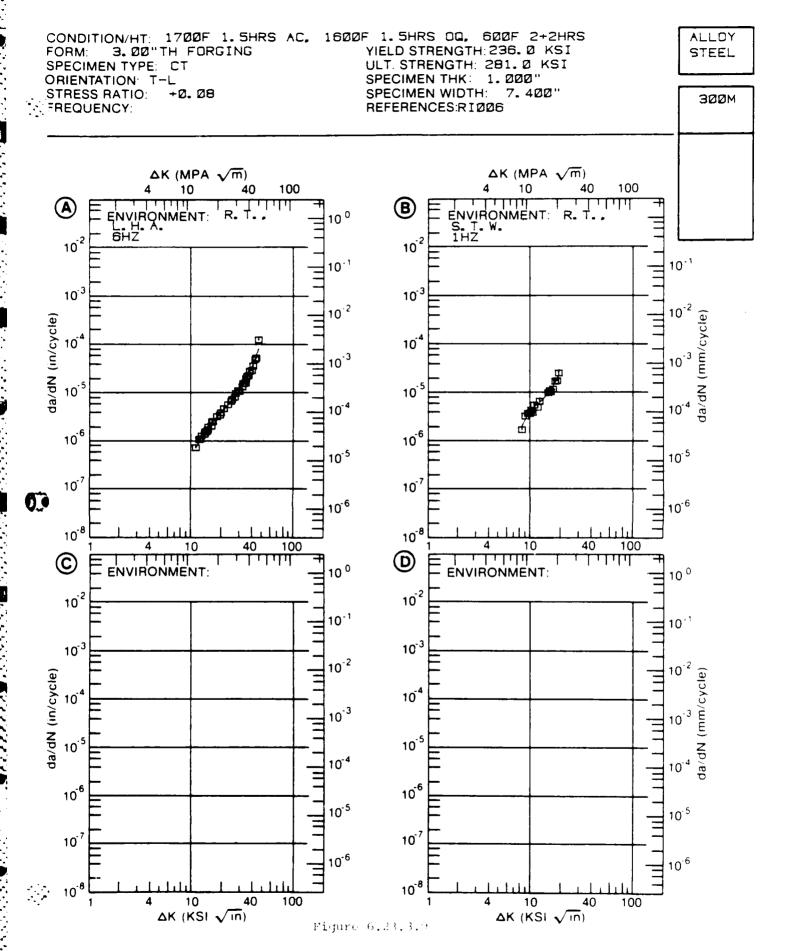
DATA ASSOCIATED WITH FIGURE 6.23.3.2 INDICATING EFFECT

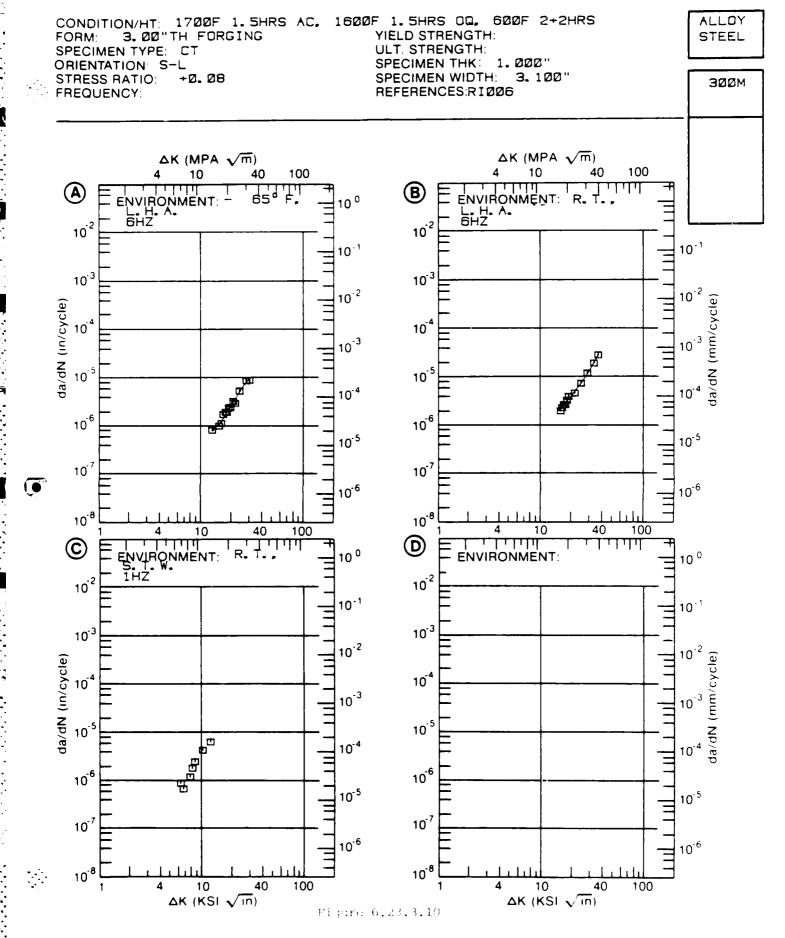### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION:

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR	E= R.T. SIM SEA WATER		
DELTA K MIN A:	4.96	.115			
B:	7.19		.440		
C:					
D:					
	5.00	.118			
	6.00	.206			
	7.00	.315			
	8.00	.442	.560		
	9.00	.587	.708		
	10.00	.749	.856		
	13.00	1.36	1.32		
	16.00	2.21	1.89		
	20.00	3.87	2.99		
	25.00	7.31	5.44		
	30.00	13.2	10.3		
	35.00	23.4	20.1		
	40.00	40.5	40.1		
	50.00	117.			
DELTA K MAX A:	52.52	151.			
B:	48.66		138.		
C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		27.12	28.80		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0.0-0.5
	0.5-0.8
	0.8-1.25
	1.25-2.0
	>2.0

CONDITION/HT:
FORM: 1.25"TH FORGING   YIELD STRENGTH:240. 0- 246. 5 KSI
SPECIMEN TYPE: WOL   ULT. STRENGTH: 290. 5- 299. 0 KSI
ORIENTATION: T-L   SPECIMEN THK: 1.250"
STRESS RATIO: +0. 02   SPECIMEN WIDTH: 5. 000"
FREQUENCY: 0. 10- 20. 00 HZ   REFERENCES:MA005

ALLOY STEEL

300M

Figure 6.23.3.2

TABLE 6.23.3.3

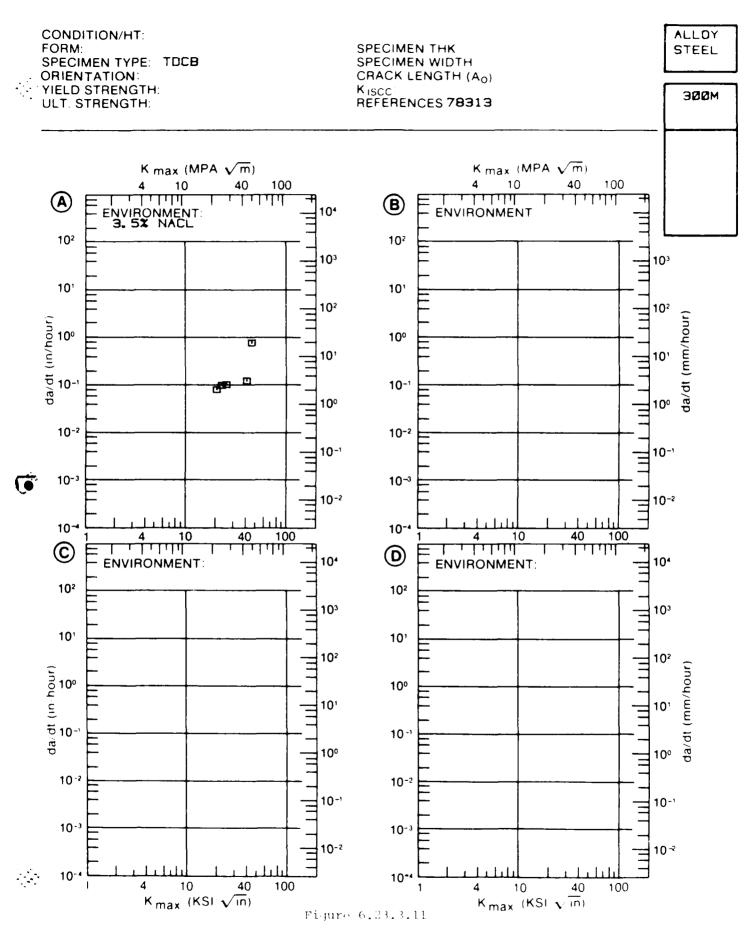FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   300M
CONDITION: TUS=280-300KSI
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=-1.00	R=+0.02	R=+0.50	
DELTA K MIN	A:	12.40	.968			
	B:	12.11		.803		
	C:	8.73			.670	
	D:					
		9.00			.738	
		10.00			1.02	
		13.00	1.16	1.05	2.11	
		16.00	2.26	2.03	3.64	
		20.00	3.79	3.56	6.52	
		25.00	5.83	5.85	12.1	
		30.00	8.37	8.89	21.1	
		35.00	12.1	13.3		
		40.00	17.8	20.0		
		50.00	42.4	47.0		
		60.00	113.	232.		
DELTA K MAX	A:	64.78	187.			
	B:	66.09		2803.		
	C:	31.97			46.4	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			10.81	7.40	4.65	

LIFE   0.0-0.5
PREDICTION 0.5-0.8
  RATIO   0.8-1.25
  SUMMARY   1.25-2.0
  (NP/NA)   >2.0

CONDITION/HT: TUS-280-300KSI
FORM: 4.25"TH BAR
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 234.5 KSI
ULT. STRENGTH: 282.5 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 4.000"
REFERENCES: MA006

ALLOY STEEL

300M

(A) STRESS RATIO = -1.00
(B) STRESS RATIO = +0.02
(C) STRESS RATIO = +0.50
(D) STRESS RATIO =

Figure 6.23.3.3

6.23-19

TABLE 6.23.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   300M
CONDITION: UTS=280-300KSI
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=-1.00	R=+0.00	R=+0.50	
A: 11.81		.39			
DELTA K B: 11.83			.45		
MIN C: 6.00				.17	
D:					
7.00				.272	
8.00				.382	
9.00				.508	
10.00				.657	
13.00		.684	.664	1.32	
16.00		1.67	1.42	2.65	
20.00		3.18	2.96	6.97	
25.00		5.47	5.73	25.1	
30.00		9.27	9.53		
35.00		17.0	14.5		
40.00		34.4	20.7		
50.00		188.	38.0		
60.00			63.8		
70.00			102.		
A: 55.73		573.			
DELTA K B: 79.71			154.		
MAX C: 27.15				286.	
D:					

ROOT MEAN SQUARE PERCENT ERROR	22.63	21.35	26.95

LIFE   0.0-0.5
PREDICTION 0.5-0.8
 RATIO   0.8-1.25
 SUMMARY   1.25-2.0
 (NP/NA)   >2.0

CONDITION/HT: UTS-280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
FREQUENCY: 10.00 HZ
ENVIRONMENT: R.T.,L.H.A.

YIELD STRENGTH:248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900-   4.000"
REFERENCES:MA007, MA010

ALLOY
STEEL

300M

Figure 6.3.3.9

6.3.10

TABLE 6.23.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.5 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: TUS=280-300KSI

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			E= R.T. 3.5% NACL	E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED	E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC
DELTA K MIN	A:	16.55	.723			
	B:	11.30		.983		
	C:	11.22			.382	
	D:	11.50				.386
		13.00		1.08	.543	.524
		16.00		1.51	1.01	.971
		20.00	2.24	2.61	2.17	2.05
		25.00	6.17	4.99	4.65	4.41
		30.00	12.3	8.51	8.12	7.89
		35.00	21.5		11.9	12.1
		40.00	35.9			16.5
		50.00	100.			
DELTA K MAX	A:	55.70	186.			
	B:	32.23		10.4		
	C:	37.07			13.4	
	D:	40.07				16.5
ROOT MEAN SQUARE PERCENT ERROR			39.88	8.55	18.05	19.59

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: TUS-280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 10.00 HZ

YIELD STRENGTH: 248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900-   4.000"
REFERENCES: MA007, MA010

ALLOY
STEEL

300M

(A) ENVIRONMENT: R.T..
3.5% NACL

(B) ENVIRONMENT: R.T..
ALT IMMERSION SEA
H2O-IMMERSED

(C) ENVIRONMENT: R.T..
ALT IMMERSION SEA
H2O-1ST HALF DRY CYC

(D) ENVIRONMENT: R.T..
ALT IMMERSION SEA
H2O-2ND HALF DRY CYC

Figure 6.23.3.5

TABLE 6.23.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.6 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: TUS=280-300KSI

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. 3.5% NACL	E= R.T. ALT IMMERSION IN SEA WATER- IMMERSED	E= R.T. ALT IMMERSION IN SEA WATER- 1ST HALF DRY CYC	E= R.T. ALT IMMERSION IN SEA WATER- 2ND HALF DRY CYC
DELTA K MIN A:	18.02	2.84			
DELTA K MIN B:	14.75		1.68		
DELTA K MIN C:	14.74			1.42	
DELTA K MIN D:	14.64				.575
	16.00		2.95	2.51	.955
	20.00	4.20	8.04	7.06	2.61
	25.00	7.61	12.8	11.7	5.44
	30.00	11.4	16.0	14.8	8.94
	35.00	17.4	19.9	18.0	13.5
	40.00	28.7	27.2	23.3	19.8
	50.00	105.		50.6	
DELTA K MAX A:	57.63	367.			
DELTA K MAX B:	44.10		38.1		
DELTA K MAX C:	51.60			59.3	
DELTA K MAX D:	48.51				38.8

ROOT MEAN SQUARE PERCENT ERROR	9.87	36.02	42.11	34.38

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: TUS-280-300KSI
FORM: 3.50"TH BILLET
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.00
FREQUENCY: 1.00 HZ

YIELD STRENGTH: 248.0- 250.0 KSI
ULT. STRENGTH: 295.5- 298.0 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 3.900- 4.000"
REFERENCES: MA007, MA010

ALLOY
STEEL

300M

Figure 6.23.3.6

TABLE 6.23.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   300M
CONDITION: 1700F 1.5HRS AC,1600F 1.5HRS OQ,600F
           2+2HRS
ENVIRONMENT: R.T. ,L.H.A.

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.08	R=+0.30	R=+0.50	
DELTA K MIN	A:	5.76	.191			
	B:	10.47		.788		
	C:	9.74			.832	
	D:					
		6.00	.206			
		7.00	.283			
		8.00	.381			
		9.00	.503			
		10.00	.651		.901	
		13.00	1.28	1.52	1.84	
		16.00	2.22	2.71	3.23	
		20.00	4.03	4.88	6.83	
		25.00	7.18	8.69		
		30.00	11.2	15.3		
DELTA K MAX	A:	30.13	11.4			
	B:	34.66		30.4		
	C:	23.72			14.6	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			5.37	10.19	9.34	

LIFE   0.0-0.5
PREDICTION 0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 1700F 1.5HRS AC. 1600F 1.5HRS OQ. 600F 2+2HRS
FORM: 3.00"TH FORGING   YIELD STRENGTH:238.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 287.0 KSI
ORIENTATION: L-T   SPECIMEN THK: 1.000"
FREQUENCY: 6.00 HZ   SPECIMEN WIDTH: 7.400"
ENVIRONMENT: R.T., L.H.A.   REFERENCES:RI006

ALLOY
STEEL

300M

Figure 6.23.3.7

TABLE 6.23.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F
         2+2HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=- 65F L.H.A. 6HZ	E= R.T. L.H.A. 1HZ		
DELTA K MIN A:	11.83	.577			
B:	10.87		.744		
C:					
D:					
	13.00	.803	1.20		
	16.00	1.56	2.05		
	20.00	3.04	3.67		
	25.00	5.93	6.62		
	30.00	10.7	10.9		
	35.00	18.7	16.8		
DELTA K MAX A:	38.05	26.0			
B:	37.57		20.6		
C:					
D:					

| ROOT MEAN SQUARE PERCENT ERROR | 7.48 | 10.79 | | |

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

TABLE 6.23.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.9 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F
         2+2HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. L.H.A. 6HZ	E= R.T. S.T.W. 1HZ		
DELTA K MIN	A: 10.91	698			
	B: 8.05		1.93		
	C:				
	D:				
	9.00		3.13		
	10.00		4.28		
	13.00	1.34	7.12		
	16.00	2.41	12.0		
	20.00	4.01			
	25.00	6.73			
	30.00	11.4			
	35.00	20.1			
	40.00	37.4			
DELTA K MAX	A: 45.45	78.3			
	B: 18.47		22.5		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		11.83	10.20		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
  RATIO   0.8-1.25
  SUMMARY   1.25-2.0
  (NP/NA)   >2.0

CONDITION/HT: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F 2+2HRS
FORM: 3.00"TH FORGING   YIELD STRENGTH: 236.0 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 281.0 KSI
ORIENTATION: T-L   SPECIMEN THK: 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 7.400"
FREQUENCY: REFERENCES: RI006

ALLOY STEEL
300M

Figure 6.23.3.9

TABLE 6.23.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.10 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: 1700F 1.5HRS AC, 1600F 1.5HRS OQ, 600F
           2+2HRS

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E=- 65F L.H.A. 6HZ	E= R.T. L.H.A. 6HZ	E= R.T. S.T.W. 1HZ	
DELTA K MIN	A: 12.73	.751			
	B: 15.42		2.08		
	C:				
	D:				
	13.00	.775			
	16.00	1.27	2.29		
	20.00	2.72	4.09		
	25.00	5.91	7.59		
	30.00		13.6		
	35.00		24.2		
DELTA K MAX	A: 29.53	9.36			
	B: 36.05		27.3		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	10.41	6.22	0.00	

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 1700F 1.5HRS AC. 1600F 1.5HRS OQ. 600F 2+2HRS
FORM: 3.00"TH FORGING   YIELD STRENGTH:
SPECIMEN TYPE: CT   ULT. STRENGTH:
ORIENTATION: S-L   SPECIMEN THK: 1.000"
STRESS RATIO: +0.08   SPECIMEN WIDTH: 3.100"
FREQUENCY: REFERENCES:RI006

| ALLOY STEEL |
| 300M |

A ENVIRONMENT: - 65° F.
   L. H. A.
   6HZ

B ENVIRONMENT: R. T.,
   L. H. A.
   6HZ

C ENVIRONMENT: R. T.,
   S. T. W.
   1HZ

D ENVIRONMENT:

Figure 6.23.3.10

6.23-33

TABLE 6.23.3.11

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.11 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION:

K MAX (KSI*IN**1/2)		DA/DT (10**-3 IN/HOUR)			
		A	B	C	D
		E= 3.5% NACL			
K MAX MIN	A:				
	B:				
	C:				
	D:				
200.00					
K MAX MAX	A:				
	B:				
	C:				
	D:				

ROOT MEAN SQUARE   0.00
PERCENT ERROR

CONDITION/HT:
FORM:
SPECIMEN TYPE: TDCB
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK
SPECIMEN WIDTH
CRACK LENGTH (A_O)
K_{ISCC}
REFERENCES 78313

ALLOY
STEEL

300M

Figure 6.23.3.11

6.23-9

TABLE 6.23.3.12

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.23.3.12 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   300M
CONDITION: 1600F OQ, 575F 2+2HR

K MAX (KSI*IN**1/2)		DA/DT (10**-3 IN/HOUR)			
		A	B	C	D
		E= R.T. DIST. WATER			
K MAX MIN	A: 12.80	3.10			
	B:				
	C:				
	D:				
	13.00	23.7			
	16.00	147.			
	20.00	290.			
	25.00	368.			
	30.00	399.			
	35.00	436.			
	40.00	490.			
	50.00	682.			
	60.00	1059.			
	70.00	1793.			
	80.00	3897.			
K MAX MAX	A: 82.00	7300.			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE   34.18
PERCENT ERROR

CONDITION/HT: 1600F OQ. 575F 2+2HR
FORM: 0.1"TH SHEET
SPECIMEN TYPE: DCB   SPECIMEN THK: 0.100"
ORIENTATION: T-L   SPECIMEN WIDTH:
YIELD STRENGTH: 245.0 KSI   CRACK LENGTH (A_O):
ULT. STRENGTH: K_{ISCC}:
                            REFERENCES: 85545

ALLOY STEEL

300M

Figure 6.23.3.12

TABLE 6.23.3.13

ALLOY STEEL   300M   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN) B	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
---	P	---	R.T.	---	289.0	3.5 PCT NACL	1.500	0.500	CANT*	0.300	89.00	12.00		----	1971	84351
	P	0.48	R.T.	L-S	236.0	3.5 PCT NACL	1.500	0.480	NB	---	76.00	13.00		----	1967	74302
	F	1.75	R.T.	S-T	240.2	SIM. SEA WATER	3.091	1.242	BWOL	1.351	----	15.40		86400	1977	MA005
		1.75			240.2		3.088	1.247	BWOL	1.348	----	15.40		86400	1977	MA005
		1.75			240.2		3.101	1.249	BWOL	1.355	----	15.70		86400	1977	MA005
		1.25			240.2		3.091	1.251	BWOL	1.366	----	15.60	15.5/ 0.2	86400	1977	MA005
1500F 0.5HR OQ P 400F 2+2 HR (COARSE GRAINED STRUCTURE)	---	0.56	R.T.	---	202.0	3.5 PCT NACL	1.500	0.500	CANT*	---	36.00	12.00		----	1970	78305
1500F 0.5HR OQ P 550F 2+2 HR (COARSE GRAINED STRUCTURE)	---	0.56	R.T.	---	232.0	3.5 PCT NACL	1.500	0.500	CANT*	---	42.00	15.00		----	1970	78305
1500F 0.5HR OQ P 550F 2+2 HR (FINE GRAINED STRUCTURE)	---	0.56	R.T.	---	247.0	3.5 PCT NACL	1.500	0.500	CANT*	---	56.00	15.00		----	1970	78305
1500F 0.5HR OQ P 400F 2+2 HR (FINE GRAINED STRUCTURE)	---	0.56	R.T.	---	245.0	3.5 PCT NACL	1.500	0.500	CANT*	---	60.00	12.00		----	1970	78305
1500F 0.5HR OQ P 550F 2+2 HR (FINE GRAINED STRUCTURE)	---	0.56	R.T.	---	248.0	3.5 PCT NACL	1.500	0.500	CANT*	---	64.00	15.00		----	1970	78305
1500F 0.5HR OQ P 400F 2+2 HR (FINE GRAINED STRUCTURE)	---	0.56	R.T.	---	241.0	3.5 PCT NACL	1.500	0.500	CANT*	---	53.00	15.00		----	1970	78305
1500F 0.5HR OQ P 550F 2+2 HR (COARSE GRAINED STRUCTURE)	---	0.56	R.T.	---	246.0	3.5 PCT NACL	1.500	0.500	CANT*	---	60.00	15.00		----	1970	78305

TABLE 6.23.3.13 (Con't)

ALLOY STEEL   300M   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) (KSI*SQRT IN)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1550F 0 5HR OQ P 10F 2+2 HR (COARSE GRAINED STRUCTURE)		0 56	R T	---	240	0 3 5 PCT NACL	1 500	0 500	CANT*	---	53 00	15 00			---	1970	78305
1600F 0 5HR OQ P 400F 2+2 HR (COARSE GRAI STRUCTURE)		0 5				5 PCT NACL	1 500	0 500	CANT*	---	67 00	12 00			---	1976	78305
1600F 0 5HR OQ P 550F 2+2 HR (COARSE GRAINED STRUCTURE)		0 56	R			T NACL	1 500	0 500	CANT*	---	65 00	12 00			---	1970	78305
1600F 0 5HR OQ P 600F 2+2 HR (FINE GRAINED STRUCTURE)		0 56	R T	---		T NACL	1 500	0 500	CANT*	---	65 00	12 00			---	1970	78305
1650F 1575F OQ F 600F 2+2HR		5 00	R T	---	247 0	AIR-90PCT RH	1 500	0 480	PTSC	0 140	73 90	71 00			---	1965	74718
1600F 1600F OQ F 600F 1+1 HR	F	4 00	R T	1-S	251 5	3 5 PCT NACL	1 500	0 480	CANT	---	63 50	19 60			---	1965	74718
1600F 1 5HR 1600F 1 5HR 600F 2+2HR	F	3 00 3 00 3 00	R T	1-T	238 0 238 0 238 0	F C S	2 000 2 000 2 000	1 000 1 000 1 000	DCB DCB DCB	--- --- ---	150 00 150 00 150 00	21 00 29 00 30 00			116760 116760 116760	1976 1976 1976	R1006 R1006 R1006
1600F 1 5HR 1600F 1 5HR 600F 2+2HR	F	3 00 3 00 3 00	R T	L-T	238 0 238 0 238 0	S C S	2 000 2 000 2 000	1 000 1 000 1 000	DCB DCB DCB	--- --- ---	150 00 150 00 150 00	39 00 39 00 36 00	38 0/	1 7	116760 116760 116760	1976 1976 1976	P1005 R1006 R1006
1600F 1 5HR 1600F 1 5HR OQ 600F 2+2HR		3 00	R T	1-T	238 0	S T W	2 000	1 000	DCB	---	150 00	25 00			---	1976	R1006

TABLE 6.23.3.13 (Con't)

ALLOY STEEL   300M   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (#=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) (KSI*SQRT IN)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1700F 1.5HR AC,1600F 1.5HR OQ,600F 2+2HR	L	3.00	R.T.	L-T	238.0	S.T.W.	2.000	1.000	DCB	----	150.00	< 21.00			----	1976	R1006
1700F 1.5HR AC,1600F 1.5HR OQ,600F 2+2HR	L	3.00	R.T.	G-L	----	S.T.W.	2.000	1.000	DCB	----	150.00	< 25.00			----	1976	R1006
		3.00			----		2.000	1.000	DCB	----	150.00	< 25.00			----	1976	R1006
		3.00			----		2.000	1.000	DCB	----	150.00	16.00			76200	1976	R1006
		3.00			----		2.000	1.000	DCB	----	150.00	15.00	15.5/	0.7	76200	1976	R1006
1710F+1610F 610F	D	0.63	R.T.	L-T	250.0	3.5 PCT NACL	1.000	0.500	NB	----	58.90	18.00			---	1971	84087
		0.63			250.0		1.000	0.500	NB	----	59.80	17.60			---	1971	84087
		0.63			250.0		1.000	0.500	NB	----	54.70	16.70	17.4/	0.7	---	1971	84087
1710F+1610F 610F	D	0.63	R.T.	T-L	250.0	3.5 PCT NACL	----	0.500	CT	----	61.20	18.90			---	1971	84087
		0.63			250.0		----	0.500	CT	----	51.50	16.30			---	1971	84087
		0.63			250.0		----	0.500	CT	----	55.30	18.00			---	1971	84087
		0.63			250.0		----	0.500	CT	----	55.90	17.30	17.6/	1.1	---	1971	84087

TABLE 6.24.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M (AH) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		

FORGING

CONDITION/HT	L-T	T-L	S-L
1650F 1 HR. AC. 1350F 1 HR. OQ. -320F 0.5 HR. 600F 2+2HR. AC	46.5 ± 3.8 (3)	----	----

TABLE 6.24.2.1

ALLOY STEEL 300M (AM)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	$2.5*(K(IC)/TYS)^2$ (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	STAN DEV	DATE	REFER
1600F 1 HR, AC, 1500F 1 HR, OQ, 300F 0.5 HR, 600F 2+2HR, AC	F	4.00	R T	L-T	262.0	1.800	0.900	NB	---	0.07	43.60			1968	73300
		4.00			262.0	1.800	0.900	NB	---	0.07	45.10			1968	73300
		4.00			262.0	1.800	0.900	NB	---	0.09	50.80	46.5/	3.8	1968	73300

NOTES
(1) (AM)-AIR MELTED

TABLE 6.25.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M (VAR)   AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION	(NUMBER OF SPECIMENS)		

FORGING

CONDITION/HT	L-T	T-L	S-L
1650F 1 HR.AC.	52.2 ± 1.3 (4)	----	----
1550F 1 HR.OQ.			
-320F 0.5 HR.			
600F 2+2HR.AC			

6.25-1

TABLE 6.25.2.1

ALLOY STEEL   300M (VAR)   K(IC)

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	-----SPECIMEN----- WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYB)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
1650F 1 HR.AC.	F	4.50	R.T.	L-T	259.0	1.800	0.900	NB	---	0.10	51.10			1968	73300 (1)
1550F 1 HR.OQ.		4.50			259.0	1.800	0.900	NB	---	0.11	53.60			1968	73300 (1)
320F 0.5 HR.		4.50			259.0	1.800	0.900	NB	---	0.11	53.00			1968	73300 (1)
600F 2+2HR.AC		4.50			259.0	1.800	0.900	NB	---	0.10	51.20			1968	73300 (1)
												52.2/	1.3		

NOTES
(1) (VAR)-VACUUM ARC REMELTED

TABLE 6.26.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 300M(VM) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN))	(NUMBER OF SPECIMENS)		

PLATE

CONDITION/HT	L-T	L-T	S-L
1500F, DQ, 400F 2+2HR	48.0 ±17.0 (2)	---	---
1500F, DQ, 550F 2+2HR	49.5 ±10.6 (2)	---	---
1550F, DQ, 550F 2+2HR	62.5 ± 3.5 (2)	---	---

BILLET

CONDITION/HT	L-T	L-T	S-L
1700F, AC, 1600F 1 HR, DQ, 550F 2+2 HR	---	55.3 ± 0.3 (3)	---
1700F, AC, 1600F 1 HR, SQ 975F, DQ, 575F 2+2 HR	---	58.6 ± 2.2 (3)	---
1700F, AC, 1600F 1 HR, SQ 400F, AC, 550F 2+2 HR	---	58.0 ± 3.4 (3)	---

TABLE 6.26.2.1

ALLOY STEEL   300M(VM)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV (KSI*SQRT IN)	DATE	REFER
300M 09 400F RT HR	P	0 56	R T	L-T	202 0	1 500	0 500	NB	---	0 08	36.00		1970 78305	(1)
		0 56			245.0	1 500	0 500	NB	---	0 15	60.00	48 0/ 17.0	1970 78305	(2)
300M 09 550F RT HR	P	0 56	R T	L-T	233 0	1 500	0 500	NB	---	0 08	42 00		1970 78305	(1)
		0 56			248 0	1 500	0 500	NB	---	0 13	57.00	49 5/ 10 6	1970 78305	(2)
300M 09 400F RT HR	P	0 56	R T	L-T	242 0	1 500	0 500	NB	---	0 12	53 00		1970 78305	(1)
300M 09 550F RT HR	P	0 56	R T	L-T	248 0	1 500	0 500	NB	---	0 15	60 00		1970 78305	(1)
		0 56			248 0	1 500	0 500	NB	---	0 17	65 00	62 5/ 3 5	1970 78305	(2)
300M 09 400F RT HR	P	0 56	R T	L-T	220 0	1 500	0 500	NB	---	0 22	66 00		1970 78305	(1)
300M 09 550F RT HR	P	0 56	R T	L-T	233 0	1 500	0 500	NB	---	0 20	66 00		1970 78305	(1)
300M 09 1400F RT HR	BT	5 50	R T	T-L	239 0	2 500	1 000	CT	---	0 14	55 60		1972 84278	(3)
		5 50			239 0	2 500	1 000	CT	---	0 13	55 30		1972 84278	(3)
		5 50			239 0	2 500	1 000	CT	---	0 13	55 00	55 3/ 0 3	1972 84278	(3)
300M 09 1600F RT HR	BT	5 50	P T	T-L	242 0	2 500	1 000	CT	---	0 14	56 40		1972 84278	(3)
		5 50			242 0	2 500	1 000	CT	---	0 15	50 50		1972 84278	(3)
		5 50			242 0	2 500	1 000	CT	---	0 16	60 80	58 6/ 2 2	1972 84278	(3)
300M 09 550F BT RT HR	DT	5 50	P T	T L	244 0	2 500	1 000	CT	---	0 13	55 40		1972 84278	(3)

(1) (VACUUM MELTED)

TABLE 6.26.2.1 (Con't)

ALLOY STEEL   300M(VM)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	STAN DEV	DATE	REFER
1700F,AC,1600F, 1 HR,SQ 400F, AC,550F 2+2 HR	BT	5.50	R T	T-L	244.0	2.500	1.000	CT	---	0.14	56.70			1972	8427B (1)
		5.50			244.0	2.500	1.000	CT	---	0.16	61.80			1972	8427B (1)
												58.0/	3.4		

NOTES
(1) (VM)-(VACUUM MELTED)

6.26-3

TABLE 6.27.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4140 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION	(NUMBER OF SPECIMENS)		

FORGED BAR

CONDITION/HT	L-T	L-L	B-L
2010F 1 HR. QQ. 475F 1 HR	52.1 ± 7.4 (2)	---	---
2190F 1 HR. QQ. 400F 1 HR	81.1 ±13.2 (2)	---	---
2190F 1 HR. QQ. 475F 1 HR	66.1 ± 2.7 (2)	---	---

6.27-1

TABLE 6.27.2.1

ALLOY STEEL   4140   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	(K(IC)/TYS)**2 (IN)	2.5* (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN DEV	K(IC) STAN DEV	DATE	REFER
1600F 1 HR.OQ, 400F 1HR	FB	0.62	R.T.	L-T	210.0	2.000	0.600	CT	1.000		0.09	39.90			1973	87241 (1)
1600F 1 HR.OQ, 735F 1HR	FB	0.62	R.T.	L-T	220.0	2.000	0.600	CT	1.000		0.13	50.60			1973	87241 (1)
1600F 1 HR.OQ, 535F 1HR	FB	0.62	R.T.	L-T	230.0	2.000	0.600	CT	1.000		0.12	50.00			1973	87241 (1)
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR	P	1.00	-65	T-L	176.3 / 176.3	2.003 / 2.002	0.994 / 0.994	CT / CT	1.033 / 1.022		0.31 / 0.44	62.50 / 74.69	68.6/	8.6	1980 / 1980	MR002 / MR002
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR	P	1.00	-65	T-L	198.1 / 198.1	2.001 / 2.003	0.994 / 0.994	CT / CT	1.034 / 1.055		0.10 / 0.09	41.30 / 38.90	40.1/	1.7	1980 / 1980	MR002 / MR002
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR	P	1.00	R.T.	T-L	157.4	2.003	0.994	CT	1.024		0.71	85.30			1980	MR002
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR	P	1.00	R.T.	T-L	175.0	2.003	0.994	CT	1.040		0.28	58.70			1980	MR002
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 900F 1HR	P	1.00	165	T-L	156.0 / 156.0	2.000 / 1.998	0.990 / 0.994	CT / CT	0.991 / 1.015		0.73 / 0.73	84.40 / 84.60	84.5/	0.1	1980 / 1980	MR002 / MR002
1600F 1HR, 1550F 1HR, OQ AT 150-175F, 800F 1HR	P	1.00	165	T-L	167.7 / 167.7	2.002 / 2.000	0.994 / 0.990	CT / CT	1.045 / 1.037		0.44 / 0.38	71.10 / 66.19	68.6/	3.5	1980 / 1980	MR002 / MR002
2010F 1 HR.OQ, 400F 1 HR	FB	0.62	R.T.	L-T	200.0	2.000	0.600	CT	1.000		0.22	59.20			1973	87241 (1)
2010F 1 HR.OQ, 475F 1 HR	FB	0.62	R.T.	L-T	210.0	2.000	0.600	CT	1.000		0.12	46.80			1973	87241 (1)

NOTES
(1) COMPOSITION(WT PERCENT) 0.40C, 0.94MN, 0.00BP, 0.012SI, 0.28SI, 0.09NI, 0.90CR, 0.17CU

6.27-2

TABLE 6.27.2.1 (Con't)

ALLOY STEEL   4140   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	SPECIMEN THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5*(K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV	DATE	REFER
2150F 1 HR, OQ. 475F 1 HR	FB	0.62	RT	L-T	210.0	2.000	0.600	CT	1.000	0.19	57.30	52.1/ 7.4	1973	87241 (1)
2150F 1 HR, OQ. 400F 1 HR	FB	0.62 / 0.62	RT	L-T	200.0 / 200.0	2.000 / 2.000	0.600 / 0.600	CT / CT	1.000 / 1.000	0.51 / 0.32	90.40 / 71.70	81.1/13.2	1973 / 1973	87241 (1) / 87241 (1)
2150F 1 HR, OQ. 660F 1 HR	FB	0.62	RT	L-T	202.0	2.000	0.600	CT	1.000	0.17	53.20		1973	87241 (1)
2150F 1 HR, OQ. 615F 1 HR	FB	0.62	RT	L-T	205.0	2.000	0.600	CT	1.000	0.14	48.50		1973	87241 (1)
2150F 1 HR, OQ. 475F 1 HR	FB	0.62 / 0.62	RT	L-T	210.0 / 210.0	2.000 / 2.000	0.600 / 0.600	CT / CT	1.000 / 1.000	0.26 / 0.23	68.00 / 64.20	66.1/ 2.7	1973 / 1973	87241 (1) / 87241 (1)

NOTES
(1)   COMPOSITION(WT PERCENT) 0.40C, 0.94MN, 0.008P, 0.012S, 0.28SI, 0.09NI, 0.90CR, 00.17CU

TABLE 6.27.3.1

ALLOY STEEL   4140   K(IBCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (*=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1550F 1HR OQ, 1250F 1HR AC	P	---	R.T.	---	105.0	WATER SAT H2S	3.250	1.000	CT	1.000	---	36.00			1972	84963
1550F 1HR OQ, 1000F 1HR AC, 1125F 1HR AC	P	---	R.T.	---	147.5	WATER SAT H2S	3.250	1.000	CT	1.000	---	17.50			1972	84963
1700F.1600F OQ 750F 1+1 HR	P	0.25	R.T.	---	195.0	DIST. WATER	1.000	0.250	CANT*	0.200	49.40	15.00		> 6000	1965	63061
1700F.1600F OQ 600F 1+1 HR	P	0.25	R.T.	---	241.0	DIST. WATER	1.000	0.250	CANT*	0.200	40.10	11.00		> 7000	1965	63061

TABLE 6.28.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 4330V MOD AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD DEVIATION (KSI SQRT(IN)) (NUMBER OF SPECIMENS)	
	L-T	T-L
PLATE		
HEAT TREATED TO 46 RC HARDNESS	74.7 ± 0.8 (2)	---
FORGED BAR		
CONDITION/HT	L-T	T-L
1600F 1 HR, OQ, 535F 1 HR	96.7 ± 3.8 (2)	---
BILLET		
CONDITION/HT	L-T	T-L
1650F 1 HR AC, 1575F 1 HR, OQ, 800F 2+2 HR	96.1 ± 3.2 (3)	---
1650F 1 HR AC, 1575F 1 HR, OQ, 525F 2+2 HR	81.6 ± 2.3 (6)	---

TABLE 6.28.2.1

ALLOY STEEL   4330V MOD   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) MEAN (KSI*SQRT IN)	K(IC) STAN DEV	DATE	REFER
-------	BT	2.20	-65	L-T	194.5	2.502	1.259	CT	1.155	0.14	43.30		1974	MA011
		2.20			194.5	2.507	1.260	CT	1.153	0.13	44.30	44.8/ 0.7	1974	MA011
-------	BT	2.20	RT	L-T	194.5	2.504	1.253	CT	1.164	0.43	80.70		1974	MA011
HEAT TREATED TD 46 RC HARDNESS	P	0.62	RT	T-L	193.0	1.502	0.750	NB	0.762	0.38	75.20		1971	B4029
		0.62			193.0	1.498	0.750	NB	0.758	0.37	74.10	74.7/ 0.8	1971	B4029
1600F 1 HR.OQ, 400F 1 HR	FB	0.62	RT	L-T	198.0	2.000	0.600	CT	1.000	0.49	88.00		1973	B7241 (1)
1600F 1 HR.OQ, 535F 1 HR	FB	0.62	RT	L-T	202.0	2.000	0.600	CT	1.000	0.60	99.40		1973	B7241 (1)
		0.62			202.0	2.000	0.600	CT	1.000	0.54	94.00	96.7/ 3.8	1973	B7241 (1)
1650F 1 HR.AC, 1575F 1 HR.OQ, 900F 2+2 HR	BT	6.00	RT	L-T	191.0	2.500	1.000	CT	1.400	0.68	99.70		1972	B4277
		6.00			191.0	2.500	1.000	CT	1.400	0.60	93.80		1972	B4277
		6.00			191.0	2.500	1.000	CT	1.400	0.61	74.70	96.1/ 3.2	1972	B4277
1650F 1 HR.AC, 1575F 1 HR.OQ, 525F 2+2 HR	BT	6.00	RT	L-T	203.0	2.500	1.000	CT	1.400	0.48	84.20		1972	B4277
		6.00			203.0	2.500	1.000	CT	1.400	0.34	77.50		1972	B4277
		6.00			203.0	2.500	1.000	CT	1.400	0.45	81.20		1972	B4277
		6.00			203.0	2.500	1.000	CT	1.400	0.46	82.20		1972	B4277
		6.00			203.0	2.500	1.000	CT	1.400	0.39	82.80		1972	B4277
		6.00			203.0	2.500	1.000	CT	1.400	0.38	81.60	81.6/ 2.3	1972	B4277

NOTES
(1) COMPOSITION(WT PERCENT) 0.28C,1.02MN,0.009P,0.005S,0.28SI,1.80NI,0.85CR,0.07V,0.01CU

TABLE 6.28.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.28.3.1 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   4330V (MOD)
CONDITION:
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=+0.02			
DELTA K MIN	A: 9.72	:	1.88			
	B:	:				
	C:	:				
	D:	:				
	10.00	:	2.11			
	13.00	:	4.61			
	16.00	:	6.32			
	20.00	:	7.44			
	25.00	:	8.24			
	30.00	:	9.30			
	35.00	:	11.2			
	40.00	:	14.3			
	50.00	:	28.4			
DELTA K MAX	A: 54.34	:	40.8			
	B:	:				
	C:	:				
	D:	:				

ROOT MEAN SQUARE   14.16
  PERCENT ERROR

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT:
FORM: 2.20"TH BILLET
SPECIMEN TYPE: WOL
ORIENTATION: L-T
FREQUENCY: 1.00- 30.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH:194.5 KSI
ULT. STRENGTH: 231.0 KSI
SPECIMEN THK: 1.250"
SPECIMEN WIDTH: 5.000"
REFERENCES:MA011

ALLOY
STEEL

4330V
(MOD)

Figure 6.28.3.1

ALLOY STEEL

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT		MEAN	STAN DEV	TEST TIME (MIN)	DATE	PEFER
QUENCHED + TEMPERED AT 500F	P	0.48	RT	L S	196	0.35 PCT NACL				---	1971	84351

6.28-6

TABLE 6.29.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 4340 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION (NUMBER OF SPECIMENS)		
	L-T	T-L	S-L
PLATE			
CONDITION/HT	L-T	T-L	S-L
HEAT TREATED TO 51 RC HARDNESS	-----	51.7 ± 1.3 (2)	-----
1550F,OQ, TEMPERED 800F	76.6 ± 4.6 (2)	-----	-----
1550F,OQ, TEMPERED 500F	45.3 ± 2.9 (4)	-----	-----
1600F 1HR, 1525F 2.5HR,OQ AT 150-175F, 900F 1HR	-----	88.2 ± 1.5 (2)	-----
FORGED BAR			
CONDITION/HT	L-T	T-L	S-L
1600F 1 1HR,OQ, 535F 1 HR	60.9 ± 0.8 (2)	-----	-----
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 400F 1 HR	76.8 ± 0.1 (2)	-----	-----
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 660F 1 HR	60.8 ± 0.8 (2)	-----	-----
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 535F 1 HR	60.1 ± 3.2 (2)	-----	-----

TABLE 6.29.1.1 (Con't)

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (NUMBER OF SPECIMENS) (KSI SQRT(IN)) DEVIATION		
	BILLET		
CONDITION/HT	L-T	T-L	S-L
1650F 1 HR.AC. 1525F 1 HR.OQ. 800F 2 HR	76.3 ± 3.6 (6)	----	----

TABLE 6.29.1.2

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

ENVIRONMENT LAB AIR
AT R T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN)) — FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
				2.5	5	10	20	50	100
MARTEMFERED									
	PLATE	0.02	---			492	3.12	23.0	111.0
UTS = 160 KSI	ROUND BAR	0.10	7.00				2.47		
UTS = 160 KSI	ROUND BAR	0.50	7.00		0.09				
UTS = 160 KSI	ROUND BAR	0.50	7.00			0.61	3.60		
UTS = 180 KSI	ROUND BAR	0.10	20.00-30.00			0.70	2.96	23.2	
UTS = 180 KSI	ROUND BAR	0.50	7.00		0.09				
UTS = 160 KSI	ROUND BAR	0.50	7.00			0.63			

TABLE 6.29.1.3

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

ENVIRONMENT AIR
AT 650 F

TEST CONDITIONS

SPECIMEN
ORIENTATION L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (HZ)	DELTA K LEVELS (KSI SQRT(IN))							
							FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)				
				2.5	5	10	20	50	100		
UTS = 180 KSI	ROUND BAR	0.10	7.00				2.78	39.7			
UTS = 150 KSI	ROUND BAR	0.50	7.00			0.96	5.28				
UTS = 180 KSI	ROUND BAR	0.50	20.00			1.04					

6.29-4

TABLE 6.29.1.4

FATIGUE CRACK GROWTH RATE AT DEFINED LEVELS OF THE STRESS-INTENSITY FACTOR

ALLOY STEEL 4340

ENVIRONMENT   H H A
               AT R T

TEST CONDITIONS

SPECIMEN
ORIENTATION   L-T

CONDITION/HT	PRODUCT FORM	STRESS RATIO	FREQ (Hz)	DELTA K LEVELS (KSI SQRT(IN))	FATIGUE CRACK GROWTH RATES (MICRO IN/CYCLE)					
					2 5	5	10	20	50	100
TUS 180-200KSI	BAR	0.05	3.00					2.94	17.8	
UC 18 200KSI	BAR	0.50	3.00				0.71	3.78		

TABLE 6.29.2.1

ALLOY STEEL 4340 K(IC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH (IN) W	THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN / STAN DEV (KSI*SQRT IN)	DATE	REFER
HEAT TREATED TO 51 RC HARDNESS	P	0.62	R.T.	T-L	220.0	0.999	0.499	NB	0.540	0.14	52.60	51.7/ 1.3	1971	84029
		0.62			220.0	0.998	0.498	NB	0.534	0.13	50.80		1971	84029
UTS = 180 KSI	BR	4.50	R.T.	L-T	192.9	2.007	0.992	CT	0.933	0.77	107.20		1979	DA001
1550F.OQ. TEMPERED 800F	P	1.00	R.T.	L-T	206.0	0.160	0.800	CT	0.800	0.37	73.30	76.6/ 4.6	1971	86582
		1.00			206.0	0.160	0.800	CT	0.800	---	79.80		1971	86582
1550F.OQ. TEMPERED 500F	P	1.00	R.T.	L-T	238.0	0.160	0.800	CT	0.800	---	45.80	49.3/ 2.9	1971	86582
		1.00			238.0	0.160	0.800	CT	0.800	---	46.00		1971	86582
		1.00			238.0	0.160	0.800	CT	0.800	0.09	41.20		1971	86582
		1.00			238.0	0.160	0.800	CT	0.800	---	48.00		1971	86582
1600F 1 HR.OQ, 400F 1 HR	FB	0.62	R.T.	L-T	195.0	2.000	0.600	CT	1.000	0.23	59.50		1973	87241 (1)
1600F 1 HR.OQ, 745F 1 HR	FB	0.62	R.T.	L-T	210.0	2.000	0.600	CT	1.000	0.47	91.20		1973	87241 (1)
1600F 1 HR.OQ, 660F 1 HR	FB	0.62	R.T.	L-T	217.0	2.000	0.600	CT	1.000	0.34	79.80		1973	87241 (1)
1600F 1 HR.OQ, 535F 1 HR	FB	0.62	R.T.	L-T	218.0	2.000	0.600	CT	1.000	0.19	61.40	60.9/ 0.8	1973	87241 (1)
		0.62			218.0	2.000	0.600	CT	1.000	0.19	60.30		1973	87241 (1)
1600F 1HR, 1525F 2 5HR.OQ AT 150-175F, 900F 1HR	P	1.00	R.T.	T-L	190.3	1.998	1.004	CT	1.022	0.54	89.19	90.1/ 1.3	1980	MR002
		1.00	-65		190.3	1.997	1.004	CT	1.026	0.57	91.00		1980	MR002
1600F 1HR, 1525F 2 5HR.OQ AT 150-175F, 900F 1HR	P	1.00	R.T.	T-L	179.4	2.000	1.030	CT	1.022	0.61	89.30		1980	MR002

NOTES
(1) COMPOSITION(WT PERCENT) 0.40C, 0.80MN, 0.010S, 0.24SI, 1.65NI, 0.72CR, 0.24MO, 0.17CU

TABLE 6.29.2.1 (Con't)

ALLOY STEEL   4340   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN	CRACK LENGTH (IN) A	$2.5*(K(IC)/TYS)^2$ (IN)	K(IC) (KSI·$\sqrt{\mathrm{IN}}$)	K(IC) MEAN/STAN DEV (KSI·$\sqrt{\mathrm{IN}}$)	DATE	REFER
1600F 1HR, 1525F 2.5HR,DQ AT 150-175F, 900F 1HR	P	1.00	R.T.	T-L	179.4	1.997	1.005	CT	1.027	0.59	87.19	88.2/ 1.5	1980	MR002
1600F 1HR, 1525F 2.5HR,DQ AT 150-175F, 900F 1HR	P	1.00 / 1.00	165	T-L	171.1 / 171.1	1.999 / 2.010	0.994 / 1.030	CT / CT	1.029 / 0.990	0.74 / 0.55	93.60 / 80.50	87.1/ 9.3	1980 / 1980	MR002 / MR002
1650F 1 HR,AC, 1525F 1 HR,OQ, 800F 2 HR	BT	10.00	R.T.	L-T	197.0	2.500	1.000	CT	1.400	0.37	75.80		1972	84277
		10.00			197.0	2.500	1.000	CT	1.400	0.41	79.70		1972	84277
		10.00			197.0	2.500	1.000	CT	1.400	0.38	76.50		1972	84277
		10.00			211.0	2.500	1.000	CT	1.400	0.29	71.90		1972	84277
		10.00			211.0	2.500	1.000	CT	1.400	0.30	73.00		1972	84277
		10.00			211.0	2.500	1.000	CT	1.400	0.37	81.10	76.3/ 3.6	1972	84277
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 400F 1 HR	FB	0.62 / 0.62	R.T.	L-T	195.0 / 195.0	2.000 / 2.000	0.600 / 0.600	CT / CT	1.000 / 1.000	0.39 / 0.39	76.70 / 76.90	76.8/ 0.1	1973 / 1973	87241 (1) / 87241 (1)
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 660F 1 HR	FB	0.62 / 0.62	R.T.	L-T	200.0 / 200.0	2.000 / 2.000	0.600 / 0.600	CT / CT	1.000 / 1.000	0.24 / 0.23	61.40 / 60.20	60.8/ 0.8	1973 / 1973	87241 (1) / 87241 (1)
2190F 1HR, FC TO 1600F,HOLD 0.5HR, 535F 1 HR	FB	0.62 / 0.62	R.T.	L-T	202.0 / 202.0	2.000 / 2.000	0.600 / 0.600	CT / CT	1.000 / 1.000	0.20 / 0.24	57.80 / 62.30	60.1/ 3.2	1973 / 1973	87241 (1) / 87241 (1)
2190F 1HR,OQ, 475F 1HR	FB	0.62	R.T.	L-T	200.0	2.000	0.600	CT	1.000	0.42	82.40		1973	87241 (1)
2190F 1HR,OQ, 535F 1HR	FB	0.62	R.T.	L-T	202.0	2.000	0.600	CT	1.000	0.24	62.80		1973	87241 (1)

NOTES
(1) COMPOSITION(WT PERCENT) 0.40C, 0.80MN, 0.010S, 0.24SI, 1.65NI, 0.72CR, 0.24MO, 0.19CU

TABLE 6.29.3.1

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: MARTEMPERED

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. :LAB AIR	E= R.T. DIST. WATER		
A:	7.13	.209			
DELTA K B:	8.73		.280		
MIN C:					
D:					
	8.00	.277			
	9.00	.373	.321		
	10.00	.492	.495		
	13.00	1.00	1.14		
	16.00	1.75	1.91		
	20.00	3.12	3.21		
	25.00	5.33	5.49		
	30.00	8.04	8.51		
	35.00	11.2	12.2		
	40.00	14.7	16.3		
	50.00	23.0	25.7		
	60.00	33.3	37.4		
	70.00	46.2	53.0		
	80.00	62.7	74.5		
	90.00	83.9	105.		
	100.00	111.	148.		
	130.00	258.	428.		
	160.00	603.	1287.		
A:	188.45	1360.			
DELTA K B:	189.12		3830.		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		21.77	20.96		

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: MARTEMPERED
FORM: 0.50"TH PLATE
SPECIMEN TYPE: CCP
ORIENTATION: L-T
STRESS RATIO: +0.02
FREQUENCY:

YIELD STRENGTH: 191.0- 201.5 KSI
ULT. STRENGTH: 196.0- 209.0 KSI
SPECIMEN THK: 0.246- 0.251"
SPECIMEN WIDTH:
REFERENCES: MA012

ALLOY
STEEL

4340

Figure 6.29.3.1

6.29-9

TABLE 6.29.3.2

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.2 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 160 KSI
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)	:	DA/DN (10**-6 IN./CYCLE)			
	:	A	B	C	D
	:				
	:	R=+0.50			
A: 3.99	:	.0454			
DELTA K B:	:				
MIN C:	:				
D:	:				
4.00	:	.0460			
5.00	:	.0930			
A: 5.53	:	.123			
DELTA K B:	:				
MAX C:	:				
D:	:				

ROOT MEAN SQUARE   3.21
  PERCENT ERROR

LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: UTS = 160 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 158.5 KSI
ULT. STRENGTH: 168.1 KSI
SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

(A) STRESS RATIO = +0.50

(B) STRESS RATIO =

(C) STRESS RATIO =

(D) STRESS RATIO =

Figure 6.29.3.2

TABLE 6.29.3.3

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.3 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 160 KSI
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10	R=+0.50		
A:	12.63	.780			
DELTA K B:	6.83		.229		
MIN C:					
D:					
	7.00		.244		
	8.00		.344		
	9.00		.466		
	10.00		.611		
	13.00	.847	1.20		
	16.00	1.44	2.05		
	20.00	2.47	3.60		
	25.00	4.72	6.27		
	30.00		9.78		
	35.00		14.1		
	40.00		19.3		
A:	26.50	5.79			
DELTA K B:	47.14		27.9		
MAX C:					
D:					
ROOT MEAN SQUARE PERCENT ERROR		5.24	6.09		

LIFE	0.0-0.5				
PREDICTION	0.5-0.8				
RATIO	0.8-1.25	1	1		
SUMMARY	1.25-2.0				
(NP/NA)	>2.0				

6.29-12

CONDITION/HT: UTS = 160 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: R.T., LAB AIR

YIELD STRENGTH: 158.5 KSI
ULT. STRENGTH: 168.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY
STEEL

4340

Figure 6.29.3.3

TABLE 6.29.3.4

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.4 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.10			
DELTA K MIN	A: 5.69	.0439			
	B:				
	C:				
	D:				
	6.00	.0586			
	7.00	.125			
	8.00	.223			
	9.00	.351			
	10.00	.507			
	13.00	1.10			
	16.00	1.83			
	20.00	2.96			
	25.00	4.64			
	30.00	6.72			
	35.00	9.36			
	40.00	12.8			
	50.00	23.2			
	60.00	41.4			
DELTA K MAX	A: 64.66	54.0			
	B:				
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	37.57

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	1
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

6.29-14

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 20.00- 30.00 HZ
ENVIRONMENT: R.T.,LAB AIR

YIELD STRENGTH:192.9 KSI
ULT.STRENGTH: 204.1 KSI
SPECIMEN THK: 0.251- 0.501"
SPECIMEN WIDTH: 1.975- 1.978"
REFERENCES:DA001

ALLOY
STEEL

4340

Figure 6.29.3.4

6.29-15

TABLE 6.29.3.5

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.5 INDICATING EFFECT

OF STRESS RATIO

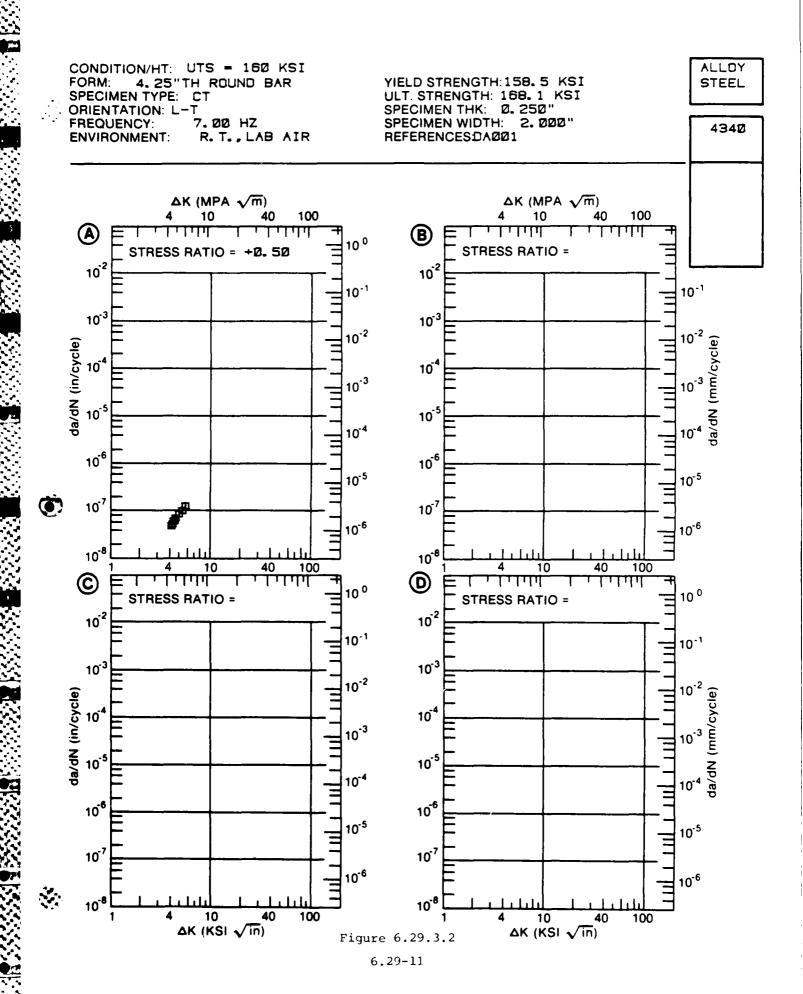MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: R.T. ,LAB AIR

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.50			
DELTA K MIN A: 6.47		.198			
DELTA K MIN B:					
DELTA K MIN C:					
DELTA K MIN D:					
	7.00	.247			
	8.00	.356			
	9.00	.486			
	10.00	.637			
	13.00	1.20			
	16.00	1.92			
DELTA K MAX A: 17.26		2.26			
DELTA K MAX B:					
DELTA K MAX C:					
DELTA K MAX D:					

ROOT MEAN SQUARE PERCENT ERROR	5.19

LIFE PREDICTION RATIO SUMMARY (NP/NA)		
LIFE	0.0-0.5	
PREDICTION	0.5-0.8	
RATIO	0.8-1.25	1
SUMMARY	1.25-2.0	
(NP/NA)	>2.0	

CONDITION/HT: UTS - 180 KSI
FORM: 4.25"TH ROUND BAR   YIELD STRENGTH: 192.9 KSI
SPECIMEN TYPE: CT   ULT. STRENGTH: 204.1 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.500"
FREQUENCY: 7.00 HZ   SPECIMEN WIDTH: 1.970"
ENVIRONMENT: R.T., LAB AIR   REFERENCES:DA001

ALLOY
STEEL

4340

Figure 6.29.3.5

6.29-17

TABLE 6.29.3.6

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.6 INDICATING EFFECT

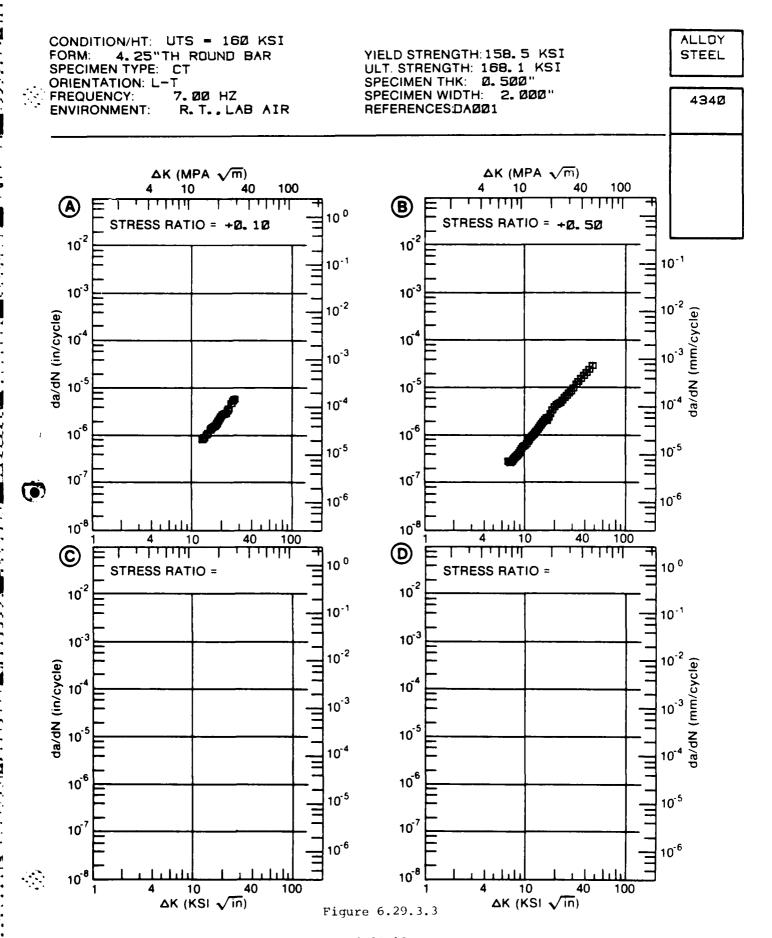### OF STRESS RATIO

MATERIAL: ALLOY STEEL 4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: + 650F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10	R=+0.50		
DELTA K MIN	A:	10.52	.249			
	B:	7.52		.511		
	C:					
	D:					
		8.00		.675		
		9.00		.813		
		10.00		1.04		
		13.00	.997			
		16.00	1.95			
DELTA K MAX	A:	18.00	2.92			
	B:	10.96		2.00		
	C:					
	D:					
ROOT MEAN SQUARE PERCENT ERROR			15.53	11.46		
LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5					
	0.5-0.8		2			
	0.8-1.25			2		
	1.25-2.0					
	>2.0					

CONDITION/HT: UTS = 180 KSI
FORM: 4. 25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 20. 00 HZ
ENVIRONMENT: + 650° F, AIR

YIELD STRENGTH:192. 9 KSI
ULT. STRENGTH: 204. 1 KSI
SPECIMEN THK: 0. 250"
SPECIMEN WIDTH: 2. 000"
REFERENCES:DA001

ALLOY
STEEL

4340

Figure 6.29.3.6

TABLE 6.29.3.7

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.7 INDICATING EFFECT

OF STRESS RATIO

MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 180 KSI
ENVIRONMENT: + 650F, AIR

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			R=+0.10			
DELTA K MIN	A:	17.58	1.91			
	B:					
	C:					
	D:					
		20.00	2.78			
		25.00	5.16			
		30.00	8.47			
		35.00	13.0			
		40.00	19.3			
		50.00	39.7			
		60.00	78.0			
		70.00	149.			
DELTA K MAX	A:	73.82	190.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	11.96

LIFE PREDICTION RATIO SUMMARY (NP/NA)	0.0-0.5	
	0.5-0.8	
	0.8-1.25	1
	1.25-2.0	
	>2.0	

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
FREQUENCY: 7.00 HZ
ENVIRONMENT: + 650° F. AIR

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.500"
SPECIMEN WIDTH: 2.000"
REFERENCES: DA001

ALLOY
STEEL

4340

Figure 6.29.3.7

6.29-21

TABLE 6.29.3.8

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.8 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: UTS = 180 KSI

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. LAB AIR	E=+ 650F AIR		
DELTA K MIN	A: 4.08	.0528			
	B: 5.72		.282		
	C:				
	D:				
	5.00	.0924			
	6.00	.178	.317		
	7.00		.454		
	8.00		.606		
	9.00		.773		
	10.00		.960		
	13.00		1.68		
	16.00		2.78		
	20.00		5.28		
DELTA K MAX	A: 6.20	.224			
	B: 22.85		8.29		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	11.27	4.65		

LIFE PREDICTION RATIO SUMMARY (NP/NA)				
LIFE	0.0-0.5			
PREDICTION	0.5-0.8			
RATIO	0.8-1.25	1	1	
SUMMARY	1.25-2.0			
(NP/NA)	>2.0			

CONDITION/HT: UTS = 180 KSI
FORM: 4.25"TH ROUND BAR
SPECIMEN TYPE: CT
ORIENTATION: L-T
STRESS RATIO: +0.50
FREQUENCY: 7.00 HZ

YIELD STRENGTH: 192.9 KSI
ULT. STRENGTH: 204.1 KSI
SPECIMEN THK: 0.250- 0.375"
SPECIMEN WIDTH: 1.500- 2.000"
REFERENCES:DA001

| ALLOY STEEL |
| 4340 |

Figure 6.29.3.8

TABLE 6.29.3.9

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.9 INDICATING EFFECT

OF STRESS RATIO
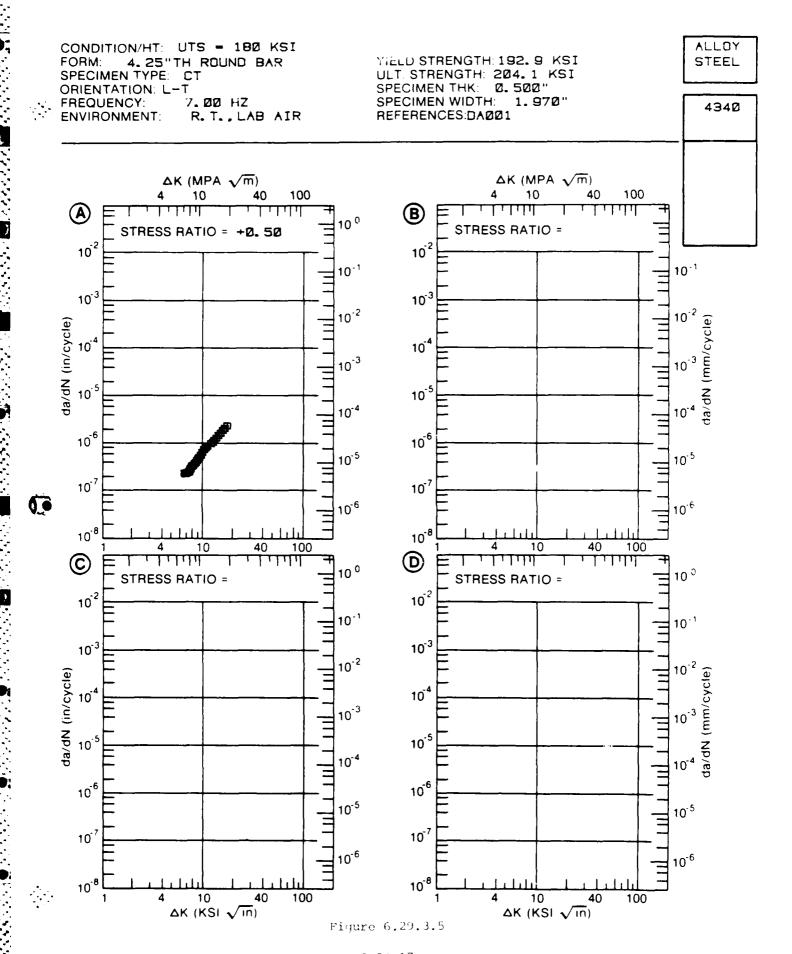
MATERIAL: ALLOY STEEL   4340
CONDITION: UTS=180-200KSI
ENVIRONMENT: R.T. ,H.H.A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		R=+0.00	R=+0.50		
DELTA K MIN	A: 18.90	2.60			
	B: 22.90		4.62		
	C:				
	D:				
	20.00	2.68			
	25.00	3.87	5.83		
	30.00	6.12	9.11		
	35.00	8.98	13.4		
	40.00	11.6	19.7		
	50.00		45.1		
	60.00		115.		
DELTA K MAX	A: 44.30	12.8			
	B: 66.10		214.		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		9.44	11.17		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: UTS=180-200KSI
FORM: 1.00"TH PLATE
SPECIMEN TYPE: CCP
ORIENTATION:
FREQUENCY: 10.00 HZ
ENVIRONMENT: R. T. , H. H. A.

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK: 0.163"
SPECIMEN WIDTH: 5.000"
REFERENCES:BW002

ALLOY
STEEL

4340

Figure 6.29.3.9

TABLE 6.29.3.10

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
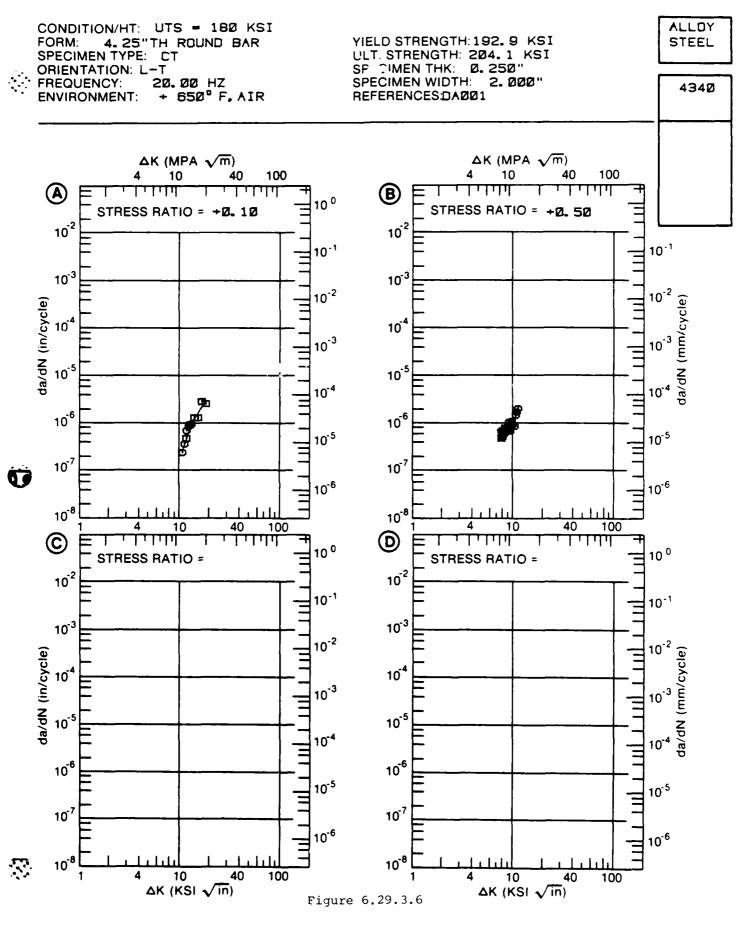
DATA ASSOCIATED WITH FIGURE 6.29.3.10 INDICATING EFFECT

OF STRESS RATIO
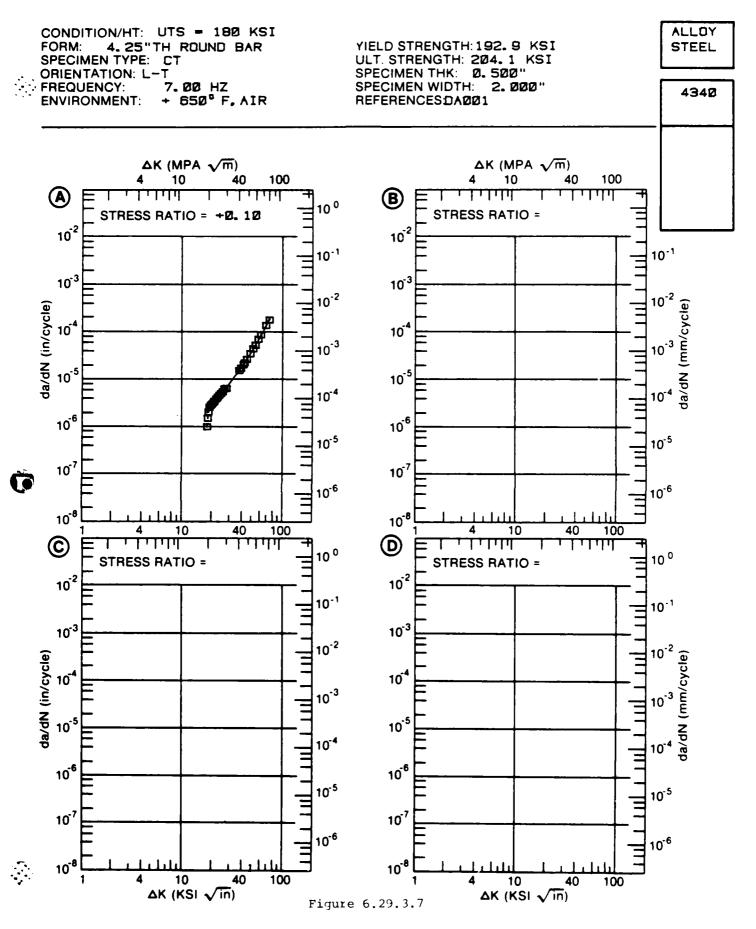

MATERIAL: ALLOY STEEL   4340
CONDITION: TUS=180-200KSI
ENVIRONMENT: R. T. , H. H. A.

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN. /CYCLE)			
		A	B	C	D
		R=+0. 05	R=+0. 50		
DELTA K MIN	A: 17. 32	1. 97			
	B: 9. 47		. 647		
	C:				
	D:				
	10. 00		. 714		
	13. 00		1. 29		
	16. 00		2. 21		
	20. 00	2. 94	3. 78		
	25. 00	5. 01			
	30. 00	7. 27			
	35. 00	9. 66			
	40. 00	12. 2			
	50. 00	17. 8			
	60. 00	24. 4			
	70. 00	32. 5			
	80. 00	42. 7			
	90. 00	55. 5			
DELTA K MAX	A: 93. 91	61. 5			
	B: 24. 31		5. 43		
	C:				
	D:				

ROOT MEAN SQUARE PERCENT ERROR	11. 52	8. 24		

LIFE PREDICTION RATIO SUMMARY (NP/NA)	
	0. 0-0. 5
	0. 5-0. 8
	0. 8-1. 25
	1. 25-2. 0
	>2. 0

CONDITION/HT: TUS-180-200KSI
FORM: 1.00"TH BAR   YIELD STRENGTH: 182.5 KSI
SPECIMEN TYPE: CCP   ULT. STRENGTH: 193.7 KSI
ORIENTATION: L-T   SPECIMEN THK: 0.400"
FREQUENCY: 3.00 HZ   SPECIMEN WIDTH: 4.000"
ENVIRONMENT: R.T., H.H.A.   REFERENCES: BW001

ALLOY
STEEL

4340

Figure 6.29.3.10

TABLE 6.29.3.11

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.11 INDICATING EFFECT

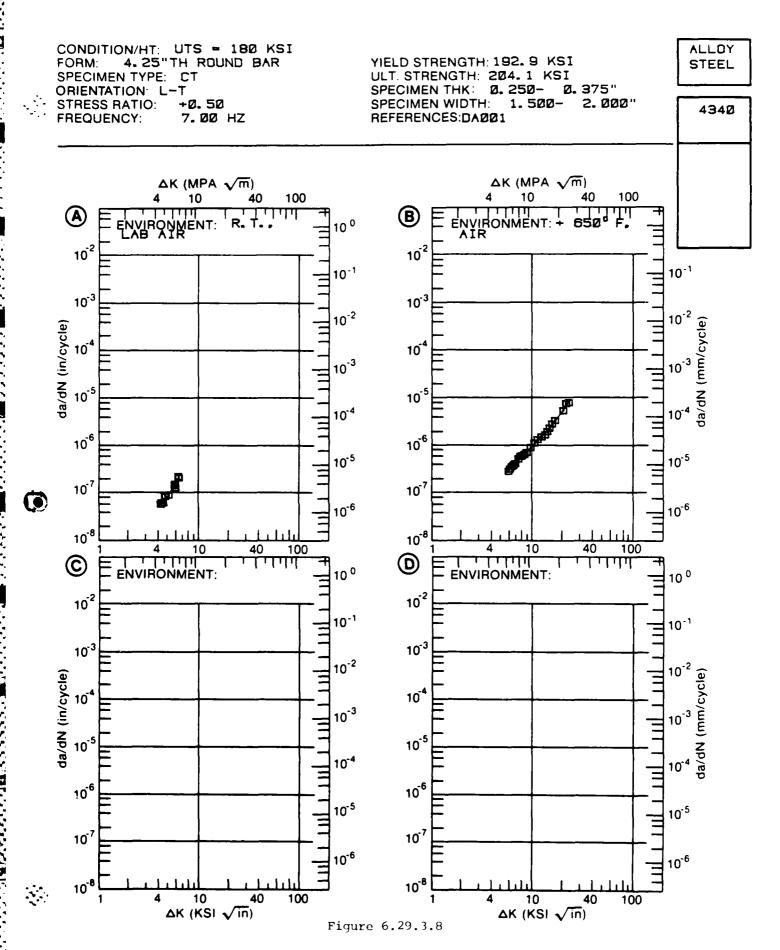### OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: 450F TEMPER

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		E= R.T. DIST. WATER	E= R.T. ARGON		
DELTA K MIN	A: 10.39	174.			
	B: 14.27		1.03		
	C:				
	D:				
	13.00	216.			
	16.00	247.	1.74		
	20.00	274.	3.21		
	25.00	298.	4.48		
	30.00	320.	5.93		
	35.00	344.	8.66		
	40.00	372.	14.6		
	50.00	443.			
	60.00	542.			
DELTA K MAX	A: 60.89	553.			
	B: 47.16		30.9		
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		2.83	10.57		

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: **450F TEMPER**
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
FREQUENCY: **0.40 HZ**

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:**89311**

ALLOY STEEL
4340

Figure 6.29.3.11

TABLE 6.29.3.12

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.12 INDICATING EFFECT

OF STRESS RATIO
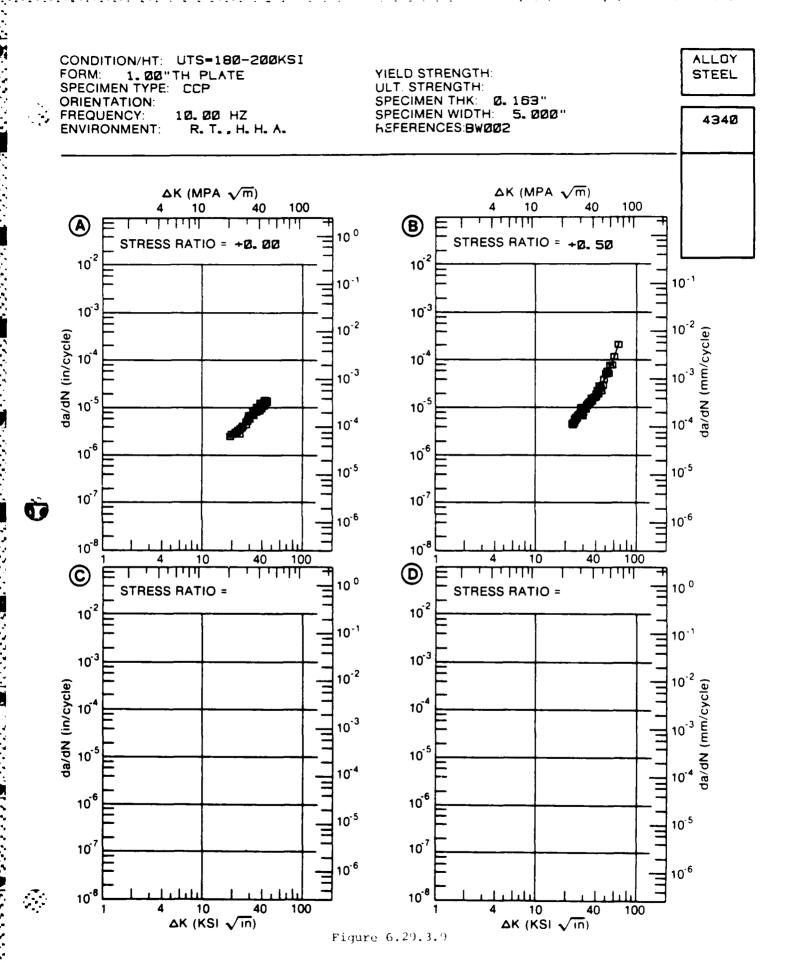

MATERIAL: ALLOY STEEL 4340
CONDITION: 750F TEMPER
ENVIRONMENT: R.T. , ARGON

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
		:	A	B	C	D
		:	R=			
DELTA K MIN	A:	15.20 :	1.14			
	B:	:				
	C:	:				
	D:	:				
		16.00 :	1.40			
		20.00 :	2.92			
		25.00 :	5.08			
		30.00 :	7.35			
		35.00 :	9.82			
		40.00 :	12.7			
		50.00 :	20.8			
		60.00 :	34.4			
DELTA K MAX	A:	63.54 :	41.5			
	B:	:				
	C:	:				
	D:	:				

ROOT MEAN SQUARE   10.54
  PERCENT ERROR

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
FREQUENCY: 0.40 HZ
ENVIRONMENT: R. T., ARGON

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:89311

ALLOY
STEEL

4340

Figure 6.29.3.12

6.29-31

TABLE 6.29.3.13

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR
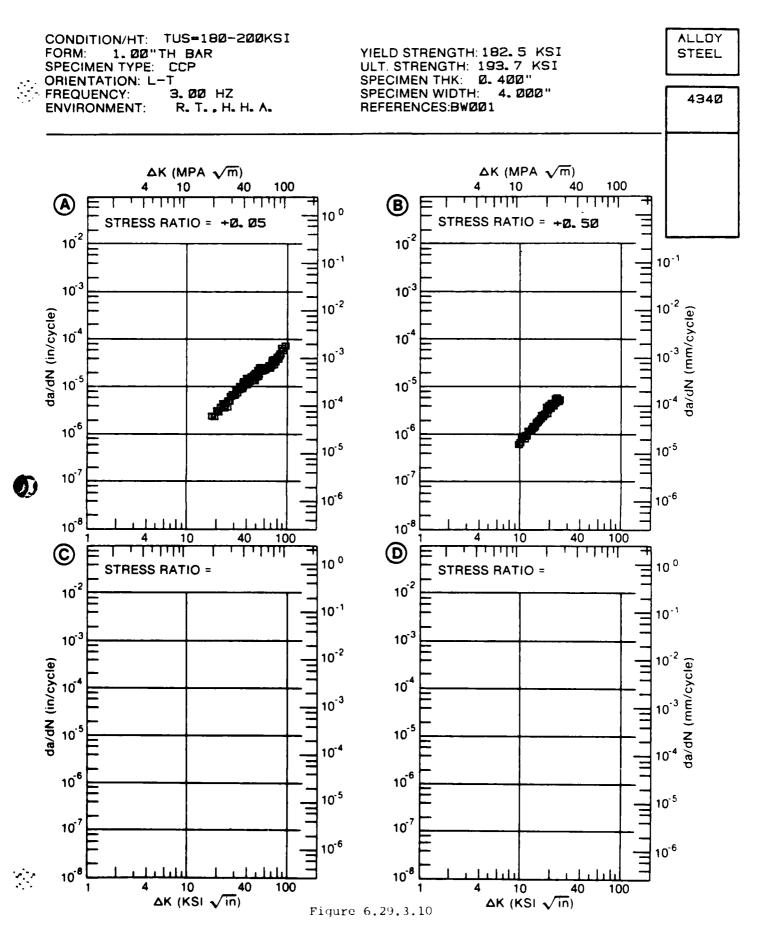
DATA ASSOCIATED WITH FIGURE 6.29.3.13 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   4340
CONDITION: 750F TEMPER
ENVIRONMENT: + 32F, DIST. WATER

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.04	F(HZ)= 0.40		
DELTA K MIN	A:	15.03	37.3			
	B:	15.64		17.7		
	C:					
	D:					
		16.00	61.0	19.5		
		20.00	217.	38.8		
		25.00	426.	54.4		
		30.00	546.	61.7		
		35.00	596.	66.1		
		40.00	623.	71.1		
		50.00	708.	90.8		
DELTA K MAX	A:	52.38	745.			
	B:	52.38		98.6		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	18.78	6.08

LIFE   0.0-0.5
PREDICTION   0.5-0.8
RATIO   0.8-1.25
SUMMARY   1.25-2.0
(NP/NA)   >2.0

CONDITION/HT: 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT: + 32° F. DIST. WATER

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY STEEL

4340

Figure 6.29.3.13

TABLE 6.29.3.14

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

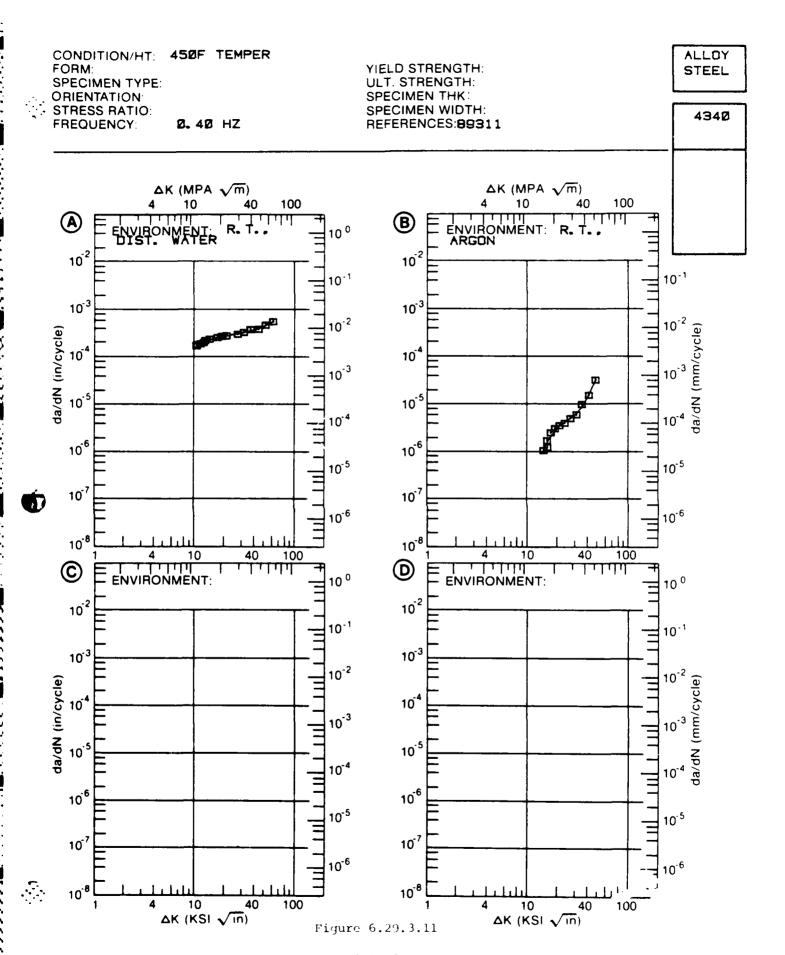### DATA ASSOCIATED WITH FIGURE 6.29.3.14 INDICATING EFFECT

OF FREQUENCY
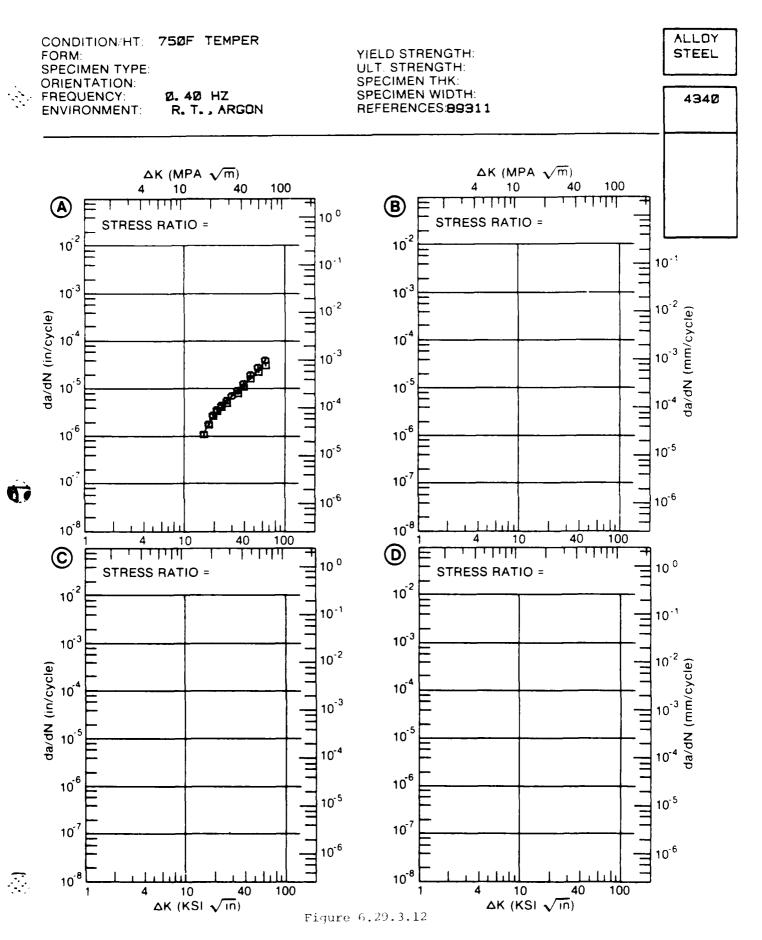

MATERIAL: ALLOY STEEL   4340
CONDITION: 750F TEMPER
ENVIRONMENT: R.T. , DIST. WATER

DELTA K (KSI*IN**1/2)		DA/DN (10**-6 IN./CYCLE)			
		A	B	C	D
		F(HZ)= 0.04	F(HZ)= 0.20	F(HZ)= 0.40	
DELTA K MIN	A: 12.35	374.			
	B: 12.41		89.0		
	C: 12.64			55.2	
	D:				
	13.00	383.	90.6	55.5	
	16.00	416.	97.8	58.8	
	20.00	452.	106.	65.0	
	25.00	489.	116.	74.8	
	30.00	522.	126.	86.1	
	35.00	555.	136.	98.7	
	40.00	587.	147.	113.	
	50.00		172.	144.	
	60.00		201.		
DELTA K MAX	A: 47.13	633.			
	B: 64.55		216.		
	C: 52.32			151.	
	D:				

ROOT MEAN SQUARE PERCENT ERROR	1.76	2.33	1.41

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT 750F TEMPER
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT   R.T., DIST. WATER

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES: 89311

ALLOY
STEEL

4340

Figure 6.29.3.14

TABLE 6.29.3.15

FATIGUE CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.15 INDICATING EFFECT

OF FREQUENCY

MATERIAL: ALLOY STEEL   4340
CONDITION: 750F TEMPER
ENVIRONMENT: + 212F, DIST. WATER

DELTA K (KSI*IN**1/2)			DA/DN (10**-6 IN./CYCLE)			
			A	B	C	D
			F(HZ)= 0.04	F(HZ)= 0.40		
DELTA K MIN	A:	10.86	1604.			
	B:	10.49		323.		
	C:					
	D:					
		13.00	2025.	337.		
		16.00	2608.	499.		
		20.00	4019.	935.		
		25.00		1812.		
DELTA K MAX	A:	20.01	4025.			
	B:	27.12		2241.		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	4.95	13.38

LIFE	0.0-0.5
PREDICTION	0.5-0.8
RATIO	0.8-1.25
SUMMARY	1.25-2.0
(NP/NA)	>2.0

CONDITION/HT: **750F TEMPER**
FORM:
SPECIMEN TYPE:
ORIENTATION:
STRESS RATIO:
ENVIRONMENT: **+ 212° F, DIST. WATER**

YIELD STRENGTH:
ULT. STRENGTH:
SPECIMEN THK:
SPECIMEN WIDTH:
REFERENCES:**89311**
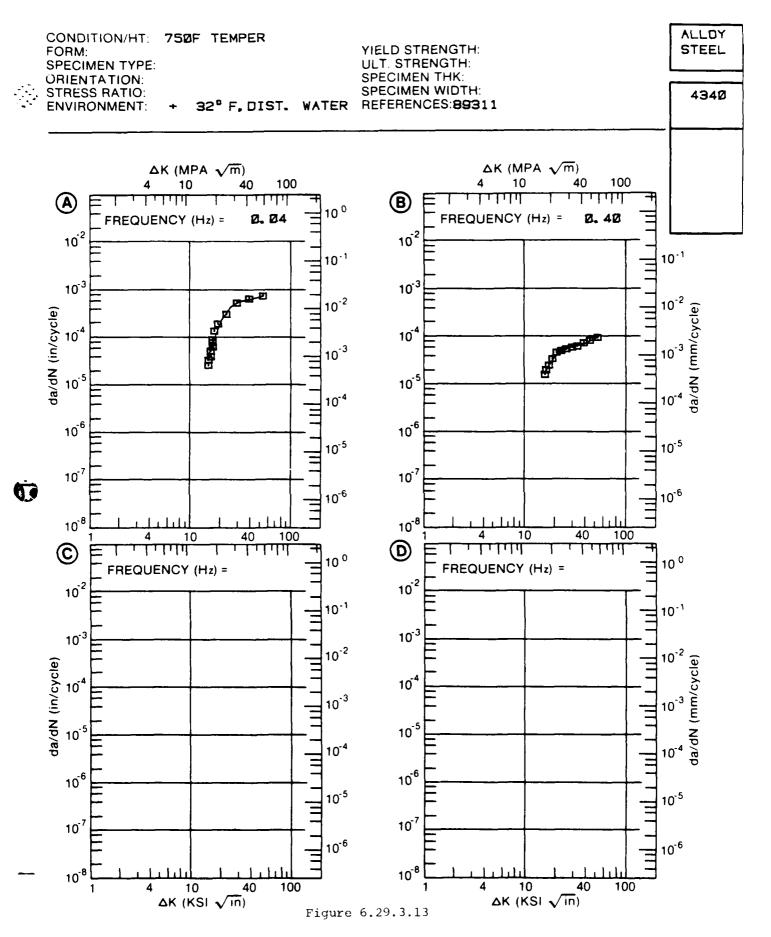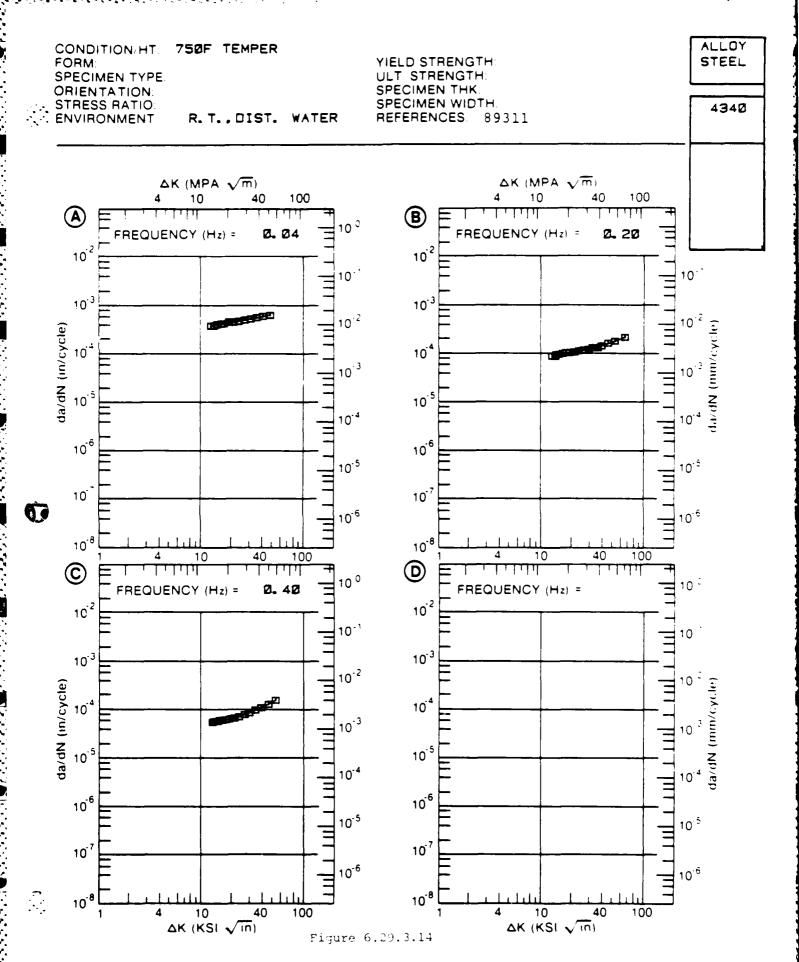
ALLOY
STEEL

4340

Figure 6.29.3.15

TABLE 6.29.3.16

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.16 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION:

K MAX (KSI*IN**1/2)	:	DA/DT (10**-3 IN/HOUR)			
	:	A	B	C	D
	:	E= HYDROGEN			
K MAX MIN A: B: C: D:	:				
200.00	:				
K MAX MAX A: B: C: D:	:				

ROOT MEAN SQUARE   0.00
PERCENT ERROR

CONDITION/HT:
FORM:
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH:
ULT. STRENGTH:

SPECIMEN THK:
SPECIMEN WIDTH:
CRACK LENGTH (A_O):
K_{ISCC}:
REFERENCES:84310

ALLOY
STEEL

4340

Figure 6.29.3.16

6.29-39

TABLE 6.29.3.17

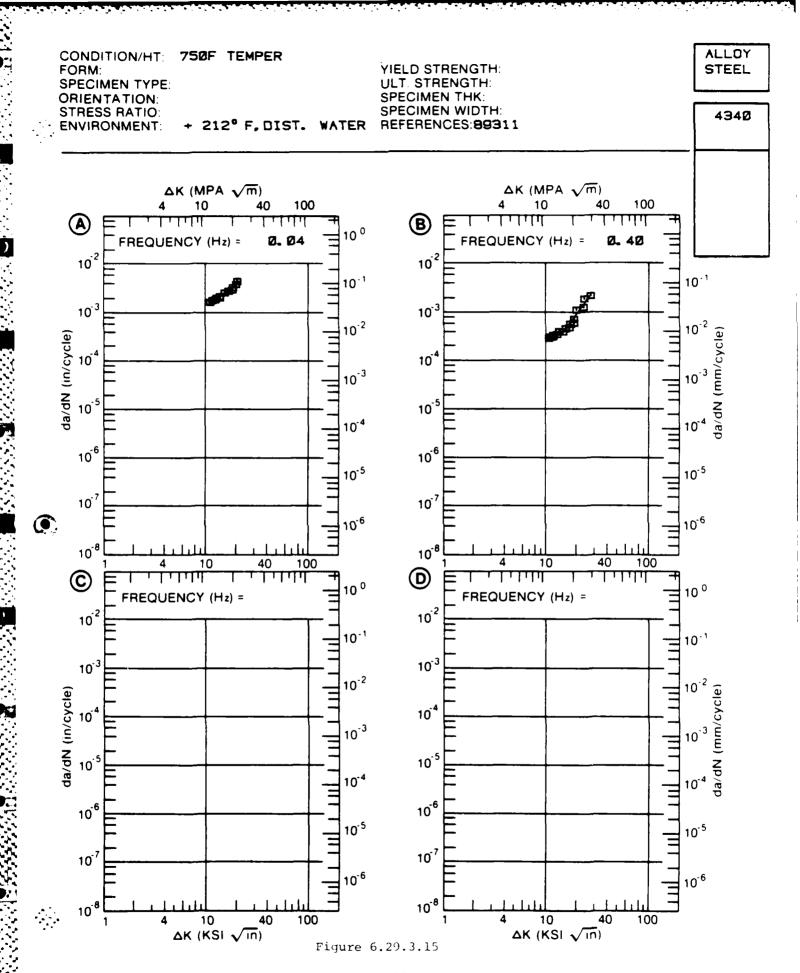## SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.17 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION:

K MAX (KSI*IN**1/2)			DA/DT (10**-3 IN/HOUR)			
			A	B	C	D
			E= 3.5% NACL, BUFFERED	E= 3.5% NACL		
K MAX MIN	A:	20.80	441.			
	B:	11.00		107.		
	C:					
	D:					
		13.00		342.		
		16.00		690.		
		20.00		832.		
		25.00	722.	829.		
		30.00	764.	952.		
		35.00	1105.	1410.		
		40.00	2989.	2717.		
K MAX MAX	A:	41.50	4613.			
	B:	42.00		3782.		
	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	18.79	43.66

CONDITION/HT:
FORM: 12.0"TH FORGING   SPECIMEN THK: 0.502"
SPECIMEN TYPE: SENT   SPECIMEN WIDTH: 3.000"
ORIENTATION: CRACK LENGTH (A₀):
YIELD STRENGTH: 220.0 KSI K_{ISCC}: 10.00 KSI (SQRT IN)
ULT STRENGTH: REFERENCES:81814

ALLOY STEEL
4340

Figure 6.29.3.17

TABLE 6.29.3.18

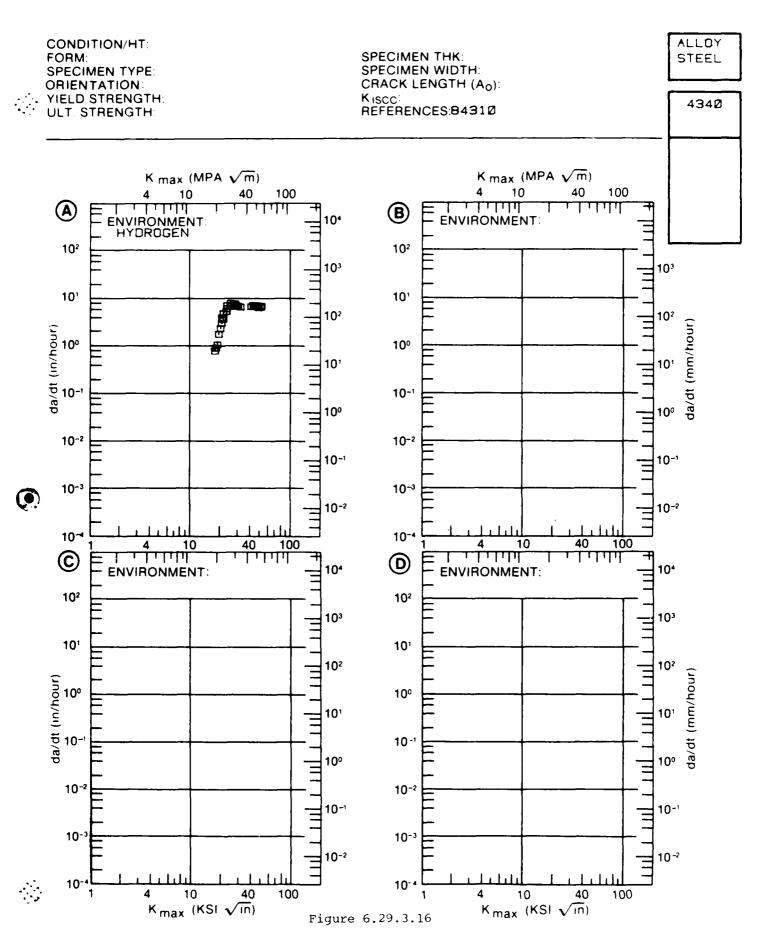## SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.18 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: TEMPER 400F 1HR

K MAX (KSI*IN**1/2)			DA/DT (10**-3 IN/HOUR)			
			A	B	C	D
			E= DRY ARGON-CNT	E= DIST. WATER-CNT	E= SEAWATER-CANT	E= DRY HYDROGEN-CNT
K MAX MIN	A:	70.00	.836			
	B:	24.00		224.		
	C:	18.80			403.	
	D:	24.00				1579.
		20.00			421.	
		25.00		266.	860.	2166.
		30.00		521.	1630.	5801.
		35.00		817.	2480.	8872.
		40.00		1114.	3517.	10742.
		50.00		1610.	7298.	13608.
		60.00		1923.		
		70.00	.836	2073.		
		80.00	1.17	2106.		
		90.00	5.73			
K MAX MAX	A:	95.30	25.2			
	B:	88.00		2079.		
	C:	60.00			18700.	
	D:	53.00				14919.
ROOT MEAN SQUARE PERCENT ERROR			36.34	11.28	7.72	3.27

CONDITION/HT: TEMPER 400F 1HR
FORM: 0.2"TH PLATE
SPECIMEN TYPE:
ORIENTATION:
YIELD STRENGTH: 195.0- 225.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
CRACK LENGTH (A_O):
K_{ISCC}:
REFERENCES:84309, 70887
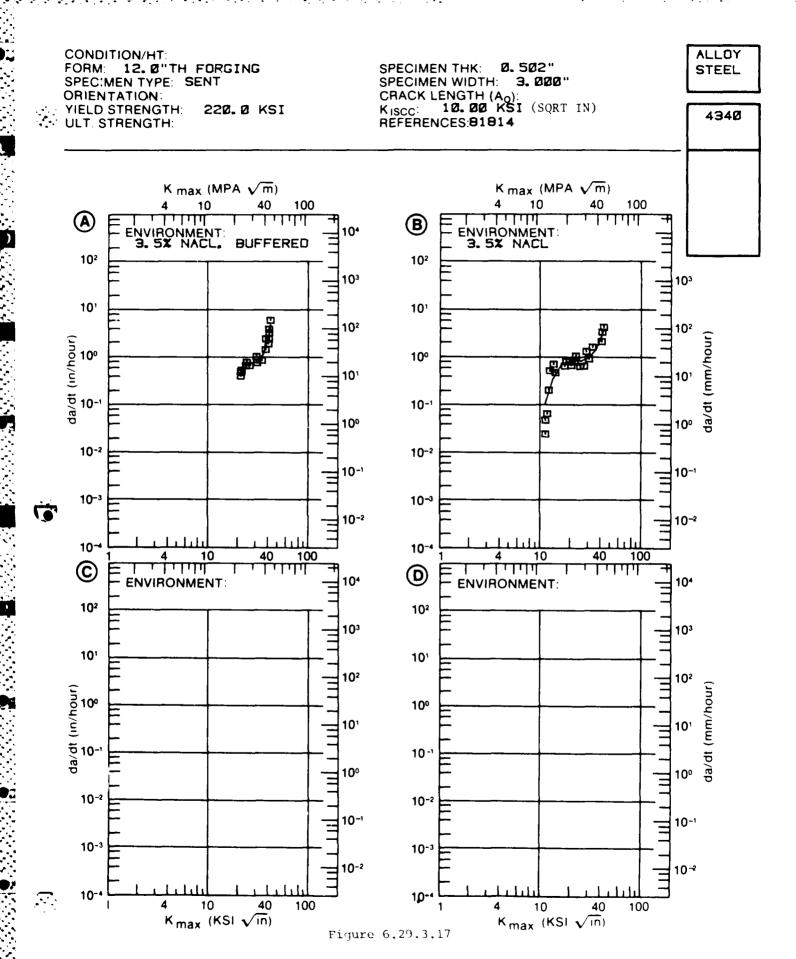
ALLOY
STEEL

4340

Figure 6.29.3.18

TABLE   6.29.3.19

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

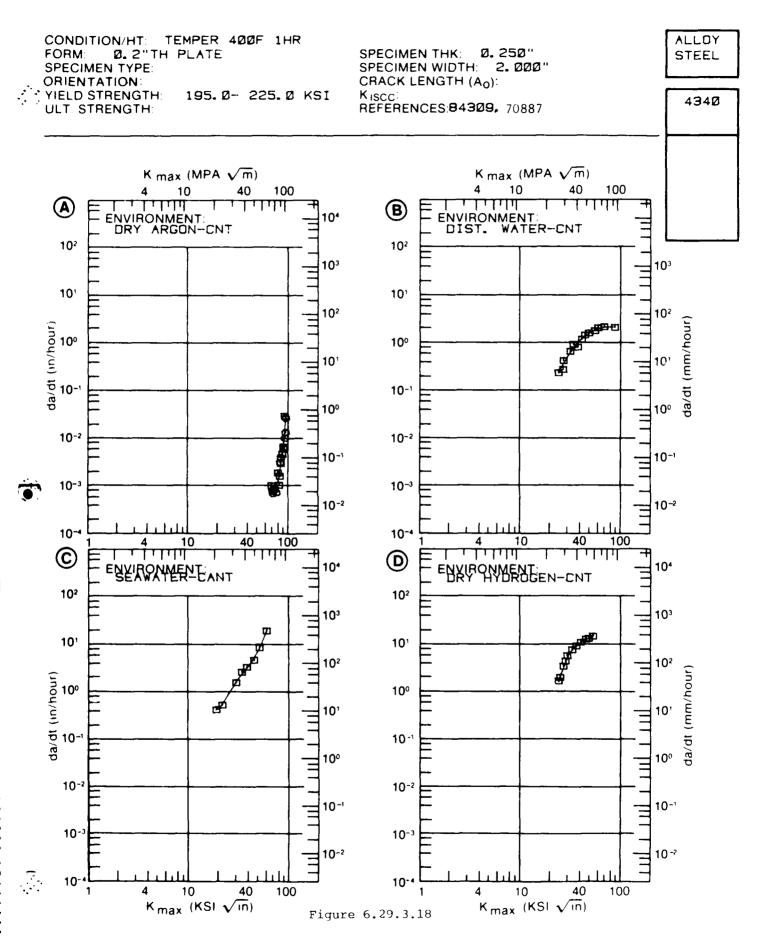### DATA ASSOCIATED WITH FIGURE 6.29.3.19 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: TEMPER 400F 1HR

K MAX (KSI*IN**1/2)		DA/DT (10**-3 IN/HOUR)			
		A	B	C	D
		E= DIST. WATER; 50F	E= DIST. WATER; 75F	E= DIST. WATER; 127F	E= DIST. WATER; 167F
K MAX MIN	A: 51.00	256.			
	B: 14.50		83.0		
	C: 26.00			2215.	
	D: 22.50				5804.
	16.00		112.		
	20.00		218.		
	25.00		412.		8072.
	30.00		663.	3694.	11332.
	35.00		947.	5200.	12816.
	40.00		1236.	6117.	13293.
	50.00		1737.	6730.	13718.
	60.00	893.	2040.	6825.	15332.
	70.00	1384.	2125.	7099.	
	80.00	1383.	2033.		
K MAX MAX	A: 81.00	1367.			
	B: 84.00		1962.		
	C: 80.00			7842.	
	D: 64.00				16594.
ROOT MEAN SQUARE PERCENT ERROR		10.41	9.95	10.87	10.02

CONDITION/HT: TEMPER 400F 1HR
FORM: 0.2"TH PLATE
SPECIMEN TYPE: CNT
ORIENTATION:
YIELD STRENGTH: 195.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.250"
SPECIMEN WIDTH: 2.000"
CRACK LENGTH (A_0):
K_{ISCC}:
REFERENCES.84309

ALLOY STEEL

4340

Figure 6.29.3.19

TABLE 6.29.3.20

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

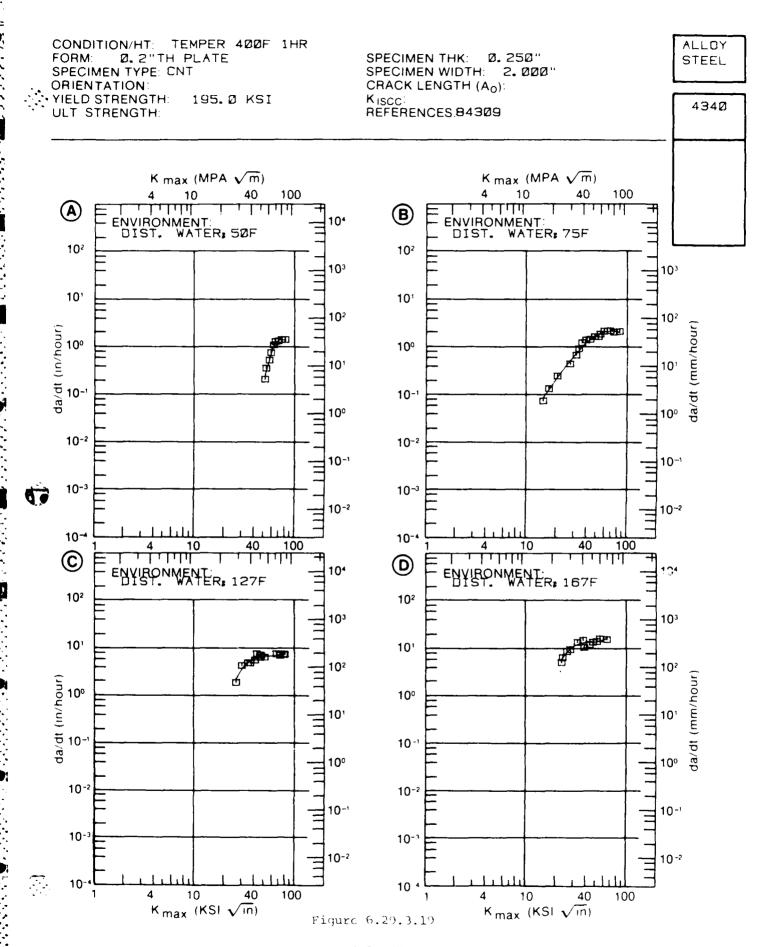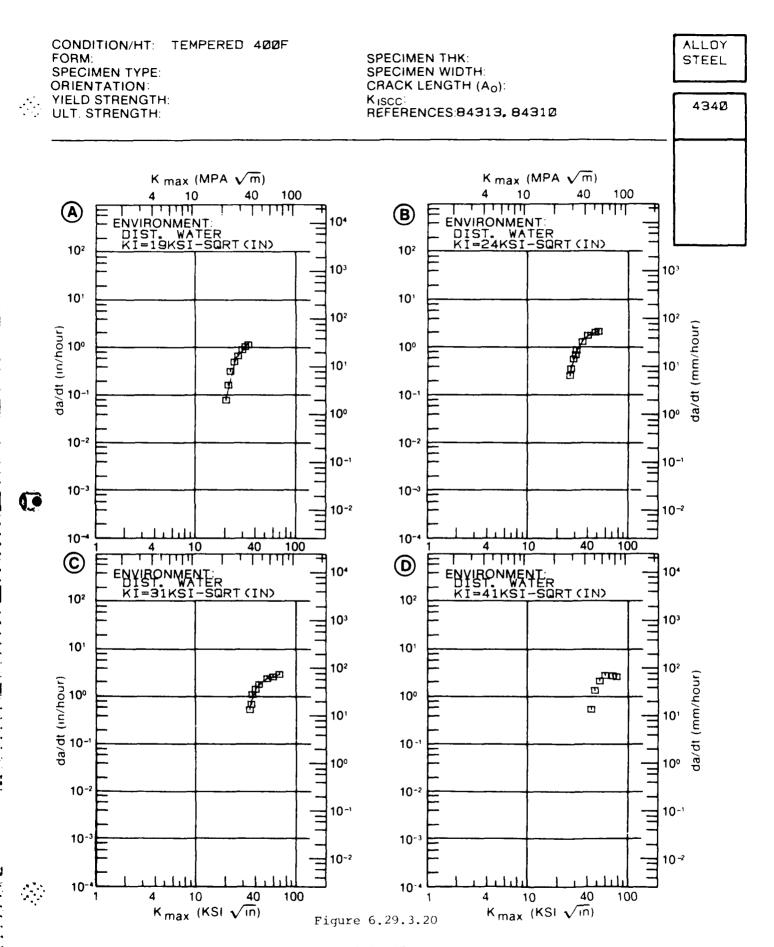### DATA ASSOCIATED WITH FIGURE 6.29.3.20 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340
CONDITION: TEMPERED 400F

K MAX (KSI*IN**1/2)			DA/DT (10**-3 IN/HOUR)			
			A	B	C	D
			E= DIST. WATER KI=19KSI SQRT(IN)	E= DIST. WATER KI=24KSI SQRT(IN)	E= DIST. WATER KI=31KSI SQRT(IN)	E= DIST. WATER KI=41KSI SQRT(IN)
K MAX MIN	A:	20.00	83.8			
	B:	26.00		300.		
	C:	33.80			579.	
	D:					
		25.00	603.			
		30.00	900.	787.		
		35.00		1383.	756.	
		40.00		1744.	1533.	
		50.00			2341.	
		60.00			2553.	
K MAX MAX	A:	33.30	1206.			
	B:	50.00		2136.		
	C:	67.50			2932.	
	D:					
ROOT MEAN SQUARE PERCENT ERROR			7.25	6.54	8.60	0.00

CONDITION/HT: TEMPERED 400F
FORM: SPECIMEN THK:
SPECIMEN TYPE: SPECIMEN WIDTH:
ORIENTATION: CRACK LENGTH (A$_O$):
YIELD STRENGTH: K$_{ISCC}$:
ULT. STRENGTH: REFERENCES:84313, 84310

| ALLOY STEEL |
| 4340 |

Figure 6.29.3.20

TABLE 6.29.3.21

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.29.3.21 INDICATING EFFECT OF ENVIRONMENT

MATERIAL: ALLOY STEEL 4340
CONDITION: TYS=200-240KSI

K MAX (KSI*IN**1/2)		DA/DT (10**-3 IN/HOUR)			
		A	B	C	D
		E= 3.5% NACL - .09 WT % SI IN ALLOY	E= 3.5% NACL - .54 WT % SI IN ALLOY	E= 3.5% NACL - 1.08 WT % SI IN ALLOY	E= 3.5% NACL - 1.58 WT % SI IN ALLOY
K MAX MIN	A:				
	B:				
	C:				
	D:				
	200.00				
K MAX MAX	A:				
	B:				
	C:				
	D:				
ROOT MEAN SQUARE PERCENT ERROR		0.00	0.00	0.00	0.00

CONDITION/HT: TYS=200-240KSI
FORM: 1.5"TH EXTRUSION
SPECIMEN TYPE: NB
ORIENTATION: L-S
YIELD STRENGTH: 202.0- 240.0 KSI
ULT STRENGTH:

SPECIMEN THK: 0.480"
SPECIMEN WIDTH: 1.500"
CRACK LENGTH (A₀):
K_{ISCC}: 14.00 KSI (SQRT IN)
REFERENCES: 74718

ALLOY
STEEL

4340

A ENVIRONMENT:
3.5% NACL - .09 WT %
SI IN ALLOY

B ENVIRONMENT:
3.5% NACL - .54 WT %
SI IN ALLOY

C ENVIRONMENT:
3.5% NACL -1.08 WT %
SI IN ALLOY

D ENVIRONMENT:
3.5% NACL -1.58 WT %
SI IN ALLOY

Figure 6.29.3.21

6.29-49

TABLE 6.29.3.22

ALLOY STEEL   4340   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (#=SG)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
	S	----	R.T.	---	----	3.5 PCT NACL	----	----	CNT	----	80.00	10.00	---	----	1968	84290
		----		---	----		----	----	PTSC	----	67.00	10.00		----	1968	84290
												10.0/	0 0			
	P	----	R.T.	L-T	----	3.5 PCT NACL	----	----	CANT	----	57.00	10.00	---	----	1968	84290
	F	0.40	R.T.	---	200.0	DIST WATER	0.394	0.394	CANT*	----	88.00	45.00	---	> 48800	1969	76972
TYS=125KSI	P	----	R.T.	T-L	125.0	SEAWATER	----	----	CANT	----	89.00	70.00*	---	----	1967	70887
TYS=150KSI	P	----	R.T.	T-L	150.0	SEAWATER	----	----	CANT	----	85.00	59.00	---	----	1967	70887
TYS=175KSI	P	----	R.T.	T-L	175.0	SEAWATER	----	----	CANT	----	75.00	27.00	---	----	1967	70887
TYS=200KSI	P	----	R.T.	T-L	200.0	SEAWATER	----	----	CANT	----	59.00	10.00	---	----	1967	70887
TYS=225KSI	P	----	R.T.	T-L	225.0	SEAWATER	----	----	CANT	----	63.00	5.00	---	> 1200	1967	70887
1350F DQ 750F 1 2HR	P	1.00	R.T.	T-S	194.0	3.5 PCT NACL	1.000	0.400	CANT	----	72.20	8.50	---	> 20000	1970	79761
1550F DQ 750F CRACK PRESTRESSED TO 60PCT KIC	P	1.00	R.T.	---	194.2	3.5 PCT NACL	1.000	0.500	NB *	----	72.20	23.00	---	> 20000	1972	84356

*NOTE-DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

6.29-50

TABLE 6.29.3.22 (Con't)

ALLOY STEEL 4340 K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN (**=SQ)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1550F OQ 750F P 1HR CRACK PRESTRESSED TO 20PCT KIC	P	1.00	R.T.	---	194.2	3.5 PCT NACL	1.000	0.500	NB *	---	72.20	8.00	---	> 20000	1972	84356
1550F OQ 750F P CRACK PRESTRESSED TO 80PCT KIC	P	1.00	R.T.	---	194.2	3.5 PCT NACL	1.000	0.500	NB *	---	72.20	24.00	---	> 20000	1972	84356
1550F OQ 750F P CRACK PRESTRESSED TO 20PCT KIC	P	1.00	R.T.	---	194.2	3.5 PCT NACL	1.000	0.500	NB *	---	72.20	12.00	---	> 20000	1972	84356
1550F OQ 750F P CRACK PRESTRESSED TO 40PCT KIC	P	1.00	R.T.	---	194.2	3.5 PCT NACL	1.000	0.500	NB *	---	72.20	17.00	---	> 20000	1972	94356
1575F OQ 675F P 4HR	P	0.75	R.T.	---	209.6	DIST WATER	0.665	0.250	CANT*	0.125	48.80	9.80	---	> 7500	1965	63061
1575F OQ 800F P 4HR	P	0.75	R.T.	---	232.4	DIST WATER	0.665	0.250	CANT*	0.125	48.60	9.80	---	> 2640	1965	63061
1600F 1HR OQ 600F 1+1HR	F	12.00	R.T.	---	220.0	3.5 PCT NACL	3.000	0.502	SENT	0.800	------	10.00	---	----	1971	81814
1625F Q 1525F OQ 400F 2+2HR 1525F Q 1525F OQ	F	8.00 / 8.00	R.T.	---	212.2 AIR 90 PCT PH / 220.B		1.300 / 1.500	0.480 / 0.480	PTSC / PTSC	0.140 / 0.140	63.00 / 63.60	27.00 / 57.00	42.0/ 21.2	200 / 1200	1965 / 1965	74718 / 74718

TABLE 6.29.3.22 (Con't)

ALLOY STEEL   4340   K(ISCC)

CONDITION	PRODUCT FORM	PRODUCT THICK (IN)	TEST TEMP (F)	SPEC DR	YIELD STR (KSI)	ENVIRONMENT	SPECIMEN WIDTH (IN) W	SPECIMEN THICK (IN) B	SPECIMEN DESIGN (4=SQ)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) (KSI*SQRT IN)	MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1650F 1HR AC 1680F 2HR OQ, LN O 25HR, 400F 1+1HR OQ	B	1.50	R.T.	L-T	245.0	3.5 PCT NACL	1.450	0.575	CANT*	----	----	51.00	15.00		> 3500	1969	75025
1650F 1HR AC 1480F 21HR OQ, LN O 25HR, 400F 1+1HR OQ	B	1.50	R.T.	L-T	249.0	3.5 PCT NACL	1.450	0.575	CANT*	----	----	51.00	15.00		> 1800	1969	75025
1700F 0.25HR AC 1550F OQ 600F 1+1HR	S	0.08	R.T.	---	206.0	DIST WATER	2.000	0.050	CNT	----	----	----	29.00*		> 1000	1968	72283
1700F 0.25HR AC 1550F OQ 600F 1+1HR	S	0.08	R.T.	---	206.0	3.5 PCT NACL	2.000	0.050	CNT	----	----	----	29.00		> 1000	1968	72283
1800F OQ 600F 1+1HR	F	1.00	R.T.	L-S	210.0	3.5 PCT NACL	----	1.000	CANT	----	82.00	30.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	25.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	24.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	23.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	82.00	25.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	22.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	82.00	25.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	82.00	24.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	24.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	82.00	31.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	78.00	26.00			----	1971	80423
		1.00			210.0		1.000	1.000	CANT	----	82.00	23.00	25.2/	2.7	----	1971	80423

*NOTE--DATA WHICH DO NOT MEET MINIMUM SPECIMEN THICKNESS REQUIREMENTS OF 2.5(KISCC/TYS)SQUARED

TABLE 6.30.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 (AM) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION	(NUMBER OF SPECIMENS)

FORGING

CONDITION/HT	L-T	T-L	S-L
1600F 1 HR.AC. 1550F 1 HR.OQ. -320F 0.5 HR. 400F 2 HR.AC	40.5 ± 0.5 (3)	----	----

TABLE 6.30.2.1

ALLOY STEEL   4340 (AM)   K(IC)

CONDITION	--PRODUCT-- FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	-------SPECIMEN------- WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYB)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN	BTAN DEV	DATE	REFER
1600F 1 HR, AC,	F	4.00	R.T.	L-T	241.0	1.800	0.900	NB	---	0.07	41.00			1968	73300 (1)
1550F 1 HR, OR,		4.00			241.0	1.800	0.900	NB	---	0.07	40.60			1968	73300 (1)
-320F 0.5 HR,		4.00			241.0	1.800	0.900	NB	---	0.07	40.00			1968	73300 (1)
400F 2 HR, AC												40.5	0.5		

NOTES:
(1) (AM)=AIR MELTED

TABLE 6.31.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF ALLOY STEEL 4340 (DH) AT ROOM TEMPERATURE

CONDITION/HT	MEAN K_{IC} ± STANDARD (KSI SQRT(IN)) DEVIATION		(NUMBER OF SPECIMENS)

FORGING

CONDITION/HT	L-T	T-L	S-L
1600F 1 HR.AC. 1550F 1 HR.OG. -320F 0.5 HR. 400F 2 HR.AC	51.0 ± 3.0 (7)	---	---

BILLET

CONDITION/HT	L-T	T-L	S-L
1550F.OG, 900F 1 HR	---	66.3 ± 6.2 (4)	---

TABLE 6.31.2.1

ALLOY STEEL 4340 (BH)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	SPECIMEN WIDTH (IN) W	THICK (IN) B	DESIGN	CRACK LENGTH (IN) A	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN/ STAN DEV	DATE	REFER
1550F OQ. 200F 1 HR	BT	1.00	-100	L-T	----	2.000	1.000	CT	1.023	----	88.00		1970	84280
		1.00			----	2.000	1.000	CT	1.030	----	103.00		1970	84280
		1.00			----	2.000	1.000	CT	1.030	----	109.00		1970	84280
		1.00			----	2.000	1.000	CT	1.026	----	94.00	98.5/ 9.3	1970	84280
1550F OQ. 200F 1 HR	BT	1.00	77	L-T	----	2.000	1.000	CT	1.045	----	107.00		1970	84280
1550F OQ. 200F 1 HR	BT	1.00	-60	T-L	----	2.000	1.000	CT	1.015	----	62.00		1970	84280
		1.00			----	2.000	1.000	CT	1.000	----	62.00		1970	84280
		1.00			----	2.000	1.000	CT	1.005	----	57.00	60.3/ 2.9	1970	84280
1550F OQ. 200F 1 HR	BT	1.00	R T	T-L	----	2.000	1.000	CT	1.000	----	75.00		1970	84280
		1.00			----	2.000	1.000	CT	1.025	----	66.00		1970	84280
		1.00			----	2.000	1.000	CT	1.010	----	63.00		1970	84280
		1.00			----	2.000	1.000	CT	1.020	----	61.00	66.3/ 6.2	1970	84280
1600F 1 HR.AC, 1550F 1 HR.OQ, -320F 0.5 HR, 400F 2 HR.AC	F	4.00	R T	L-T	229.0	1.800	0.900	NB	----	0.12	51.10		1968	73300 (1)
		4.00			229.0	1.800	0.900	NB	----	0.14	54.30		1968	73300 (1)
		4.00			229.0	1.800	0.900	NB	----	0.15	55.30		1968	73300 (1)
		4.00			231.0	1.800	0.900	NB	----	0.12	51.30		1968	73300 (1)
		4.00			231.0	1.800	0.900	NB	----	0.10	49.70		1968	73300 (1)
		4.00			231.0	1.800	0.900	NB	----	0.11	46.90		1968	73300 (1)
								NB			48.40	51.0/ 3.0		
1600F 1 HR.AC, 1550F 1 HR.OQ, -320F 0.5 HR, 400F 2 HR.AC	F	4.00	R T	T-S	233.0	1.800	0.900	NB	----	0.13	52.50		1968	73300 (1)
		4.00			233.0	1.800	0.900	NB	----	0.13	52.50		1968	73300 (1)
		4.00			233.0	1.800	0.900	NB	----	0.13	52.50	52.5/ 0.0	1968	73300 (1)

NOTES
(1) (DH)=DEGASED

6.31-2

TABLE 6.32.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

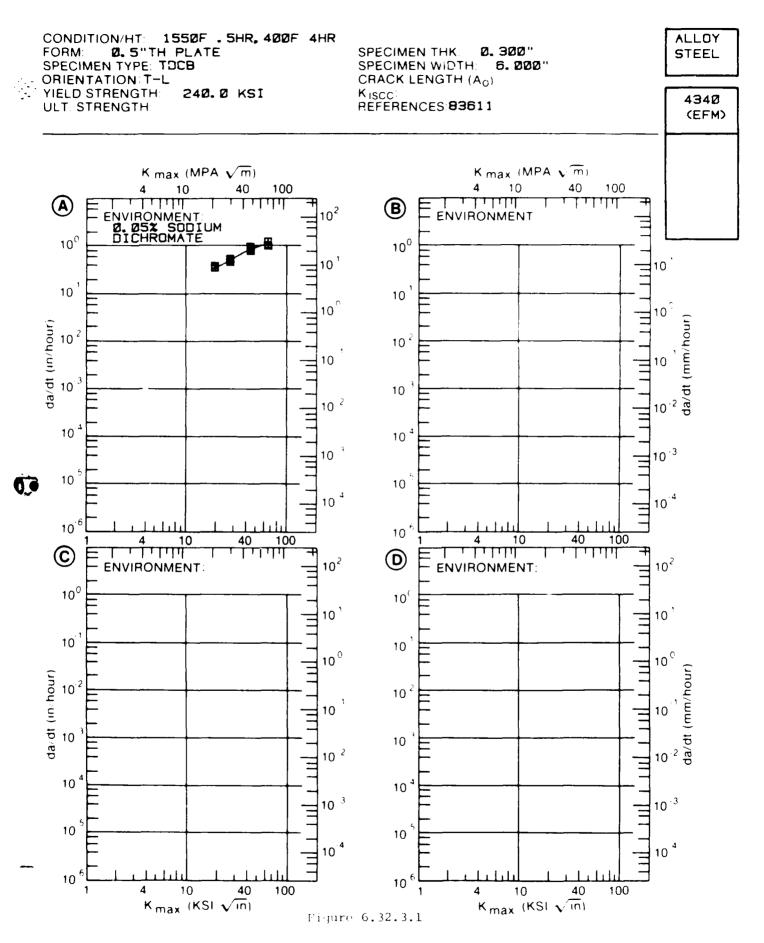### DATA ASSOCIATED WITH FIGURE 6.32.3.1 INDICATING EFFECT

OF ENVIRONMENT

MATERIAL: ALLOY STEEL   4340(EFM)
CONDITION: 1550F .5HR,400F 4HR

K MAX (KSI*IN**1/2)			DA/DT (10**-6 IN/HOUR)			
			A	B	C	D
			E= 0.05% SODIUM DICHROMATE			
K MAX MIN	A:	19.00	340000.			
	B:					
	C:					
	D:					
		20.00	356822.			
		25.00	457075.			
		30.00	572661.			
		35.00	690962.			
		40.00	801767.			
		50.00	972434.			
		60.00	1053339.			
K MAX MAX	A:	65.00	1060000.			
	B:					
	C:					
	D:					

ROOT MEAN SQUARE   9.39
PERCENT ERROR

CONDITION/HT: 1550F .5HR, 400F 4HR
FORM: 0.5"TH PLATE
SPECIMEN TYPE: TDCB
ORIENTATION: T-L
YIELD STRENGTH: 240.0 KSI
ULT. STRENGTH:

SPECIMEN THK: 0.300"
SPECIMEN WIDTH: 6.000"
CRACK LENGTH (A_0)
K_{ISCC}:
REFERENCES: 83611

ALLOY
STEEL

4340
(EFM)

Figure 6.32.3.1

TABLE 6.33.3.1

SUSTAINED CRACK GROWTH RATES AT DEFINED LEVELS
OF STRESS INTENSITY FACTOR

DATA ASSOCIATED WITH FIGURE 6.33.3.1 INDICATING EFFECT

OF YIELD STRENGTH

MATERIAL: ALLOY STEEL   4340V
CONDITION:
ENVIRONMENT:

K MAX (KSI*IN**1/2)			DA/DT (10**-6 IN/HOUR)			
			A	B	C	D
			Y(KSI)=200.0	Y(KSI)=186.0	Y(KSI)=142.0	
	A:	41.00	25343.			
K MAX	B:	55.00		885.		
MIN	C:					
	D:					
		50.00	101411.			
		60.00	174099.	4149.		
		70.00	234544.	6304.		
		80.00		8155.		
	A:	75.00	279053.			
K MAX	B:	85.00		8927.		
MAX	C:					
	D:					

ROOT MEAN SQUARE PERCENT ERROR	6.42	3.87	0.00

CONDITION/HT:
FORM   2.4"TH EXTRUSION
SPECIMEN TYPE: CANT
ORIENTATION:
ENVIRONMENT:
ULT STRENGTH:

SPECIMEN THK: 0.394"
SPECIMEN WIDTH: 0.394"
CRACK LENGTH (A₀):
K_{ISCC}: 103.0, 83.0, 45.0 KSI(SQRT IN)
REFERENCES: 76972

ALLOY
STEEL

4340V

Figure 6.23.3.1
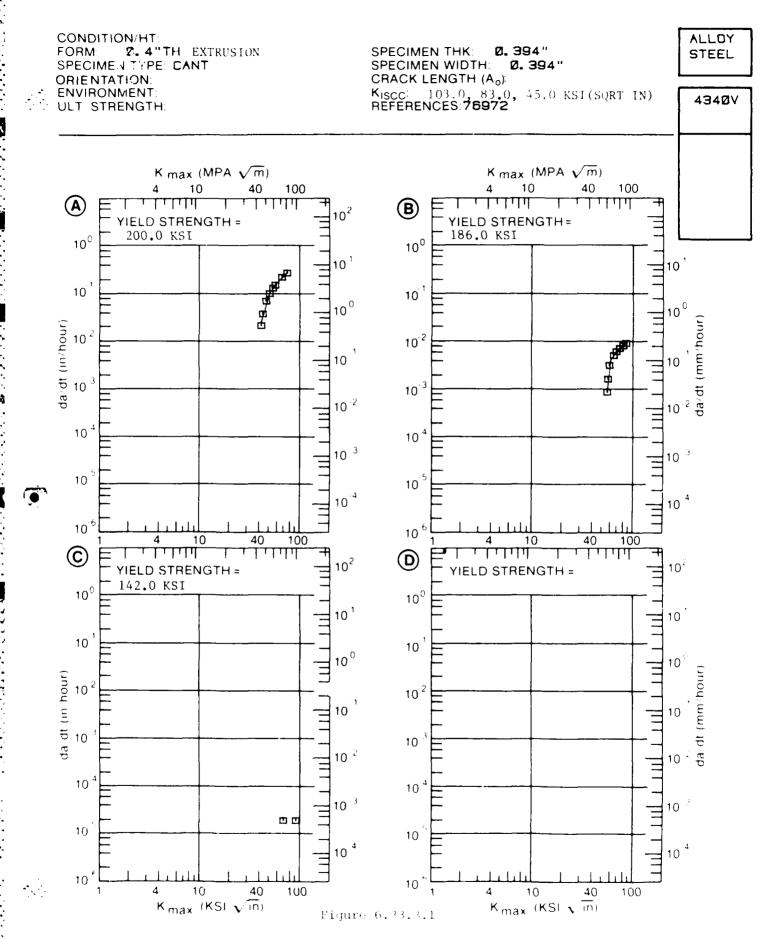
TABLE 6.34.1.1

MEAN PLANE STRAIN FRACTURE TOUGHNESS DATA OF
ALLOY STEEL 4340 (VAR) AT ROOM TEMPERATURE

CONDITION/HT	MEAN KIC ± STANDARD (KSI SQRT(IN)) DEVIATION	(NUMBER OF SPECIMENS)

FORGING

CONDITION/HT	L-T	L-L	S-L
1600F 1 HR.AC, 1550F 1 HR.OQ. -320F 0.5 HR. 400F 2 HR.AC	55.0 ± 4.4 (8)	----	----

TABLE 6.34.2.1

ALLOY STEEL   4340 (VAR)   K(IC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPECIMEN ORIENT	YIELD STRENGTH (KSI)	WIDTH W (IN)	SPECIMEN THICK B (IN)	DESIGN	CRACK LENGTH A (IN)	2.5* (K(IC)/TYS)**2 (IN)	K(IC) (KSI*SQRT IN)	K(IC) MEAN STAN DEV (KSI*SQRT IN)	DATE	REFER
1400F 1 HR,AC.	F	4.00	R T	L-T	240.0	1.800	0.900	NB	---	0.13	53.00		1968	73300 (1)
1500F 1 HR,OQ.		4.00			240.0	1.800	0.900	NB	---	0.16	61.30		1968	73300 (1)
1600F 0.5 HR.		4.00			240.0	1.800	0.900	NB	---	0.12	51.80		1968	73300 (1)
1600F 2 HR, AC		4.00			240.0	1.800	0.900	NB	---	0.15	57.20		1968	73300 (1)
		4.00			241.0	1.800	0.900	NB	---	0.10	48.60		1968	73300
		4.00			241.0	1.800	0.900	NB	---	0.13	54.60		1968	73300
		4.00			241.0	1.800	0.900	NB	---	0.11	51.10		1968	73300
		4.00			241.0	1.800	0.900	NB	---	0.15	58.60	55.0/ 4.4	1968	73300

NOTES
(1)   COMPOSITION(WT PERCENT) 0.42C, 0.81MN, 0.008P, 0.0045, 0.36SI, 1.63NI, 0.84CR, 0.22MO, 0.001AL, 0.002CA, 0.0022N
       (VAR)=(VACUUM ARC REMELTED)

C.34-2

TABLE 6.35.3.1

ALLOY STEEL   4340(MOD)   K(ISCC)

CONDITION	PRODUCT FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH W (IN)	THICK B (IN)	DESIGN (N=SO)	CRACK LENGTH A (IN)	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1650F 1HR, 1600F DQ 1+1 600F (51)	B	1.50	R.T	T-L	204.2	3.5 PCT NACL	1.500	0.480	CANT	----	78.00	18.00	---	> 5000	1965	74718
1650F 1HR, 1600F DQ 1+1 400F (51)	B	1.50	R.T	T-L	201.8	3.5 PCT NACL	1.500	0.480	CANT	----	73.00	13.00	---	> 5000	1965	74718
1800F Q 460F 1+1HR (O 20C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	87.00	56.00	---	----	1971	80423
1800F Q 500F 1+1HR (O 21C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	87.00	52.00	---	----	1971	80423
1800F Q 600F 1HR (O 20C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	98.00	72.00	---	----	1971	80423
1800F Q 650F 1HR (O 24C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	92.00	62.00	---	----	1971	80423
1800F Q 650F 1+1HR (O 28C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	87.00	35.00	---	----	1971	80423
1800F Q 700F 1HR (O 21C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	85.00	42.00	---	----	1971	80423
1800F Q 780F 1+1HR (O 33C)	F	1.00	R.T	L-S	195.0	3.5 PCT NACL	1.000	1.000	CANT	----	87.00	32.00	---	----	1971	80423

TABLE 6.35.3.1 (Con't)

ALLOY STEEL   4340(MOD)   K(ISCC)

CONDITION	-PRODUCT- FORM	THICK (IN)	TEST TEMP (F)	SPEC OR	YIELD STR (KSI)	ENVIRONMENT	WIDTH (IN) W	THICK (IN) B	DESIGN (*=50)	CRACK LENGTH (IN) A	K(Q) (KSI*SQRT IN)	K(ISCC) MEAN	STAN DEV	TEST TIME (MIN)	DATE	REFER
1800F @ 800F 1HR (0 46C)	F	1.00	R.T.	L-B	195.0	3.5 PCT NACL	1.000	1.000	CANT	----		78.00	20.00	----	1971	80423
1800F @ 900F 1HR (0 64C)	F	1.00	R.T.	L-B	195.0	3.5 PCT NACL	1.000	1.000	CANT	----		65.00	30.00	----	1971	80423
1800F @ 925F 1+1HR (0 53C)	F	1.00	R.T.	L-B	195.0	3.5 PCT NACL	1.000	1.000	CANT	----		87.00	42.00	----	1971	80423

TABLE 6.36

REFERENCES FOR ALLOY STEEL DATA

60578   18Ni (300)MAR K_c

Christian, J. L., Yang, C. T., and Witzell, W. E., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment", ASD-TDR-62-258, Part III, General Dynamics/Astronautics (December 1964).

63061   D6AC $\quad$ K_{Iscc}
$\quad\quad$ 18Ni(300)MAR K_{Iscc}
$\quad\quad$ 4140 $\quad\quad$ K_{Iscc}
$\quad\quad$ 4340 $\quad\quad$ K_{Iscc}

Mulherin, J. H., and Hess, E. H., "Stress-Corrosion Susceptibility of Ultrahigh Strength Steel Evaluated in Terms of Fracture Toughness", Technical Report R-1782, Frankford Arsenal, Philadelphia, PA, (November 1965).

65166   12Ni-5Cr-3Mo $\quad$ K_{Iscc}
$\quad\quad$ 18Ni (180)MAR $\quad$ K_{Iscc}
$\quad\quad$ 18Ni (250)MAR $\quad$ K_{Iscc}

Rolfe, S. T., et al., "Stress-Corrosion Testing of Ultraservice Steels Using Fatigue Cracked Specimens", Paper No. 90, Presented at the 69th Annual Meeting of the American Society for Testing and Materials in Atlantic City, NJ, June 27-July 1, 1966.

69162   18Ni(200)MAR K_{Iscc}

Sandoz, G., and Newbegin, R. L., "Stress-Corrosion Cracking Resistance of an 18Ni 200 Grade Maraging Steel Base Plate and Weld", NRL Report 1772, Naval Research Laboratory, Washington, D.C., (March 1967).

70887   12Ni-5Cr-3Mo $\quad$ K_{Iscc}
$\quad\quad$ 18Ni (200)MAR $\quad$ K_{Iscc}
$\quad\quad$ 18Ni (250)MAR $\quad$ da/dt
$\quad\quad$ 4340 $\quad$ da/dt, $\quad$ K_{Iscc}

Peterson, M. H., Brown, B. F., Newbegin, R. L., and Groover, R. E., "Stress Corrosion Cracking of High Strength Steels and Titanium Alloys in Chloride Solutions at Ambient Temperature", Corrosion, 23 (5), 142-148 (May 1967).

72283   D6AC $\quad\quad$ K_{Iscc}
$\quad\quad$ HP9-4-.45 $\quad$ K_{Iscc}
$\quad\quad$ H11 $\quad\quad$ K_{Iscc}
$\quad\quad$ 18Ni (250)MAR $\quad$ K_{Iscc}
$\quad\quad$ 4340 $\quad\quad$ K_{Iscc}

Benjamin, W. D., and Steigerwald, E. A., "Environmentally Induced Delayed Failures in Martensitic-High-Strength Steels", Second Yearly Summary Report, AFML-TR-68-80, TRW, Inc., Cleveland, OH, Contract AF33(615)-3651(P) (April 1968).

73300   300M (AM) $\quad$ K_{Ic}
$\quad\quad$ 300M (VAR) K_{Ic}
$\quad\quad$ 4340 (AM) $\quad$ K_{Ic}
$\quad\quad$ 4340 (DH) $\quad$ K_{Ic}

Hauser, J. J., et al., "Inclusions in High-Strength Steels, Their Dependence on Processing Variables and Their Effect on Engineering Properties", Report AFML-TR-66-222, Crucible Steel Corporation, Pittsburgh, PA, (August 1968).

TABLE 6.36   (Cont)

73612   18Ni (250)MAR K_{Ic}

Srawley, J. E., "Plane Strain Fracture Toughness Tests on Two-Inch-Thick Maraging Steel Plates at Various Strength Levels", NASA TN K-52470, Lewis Research Center, Cleveland, OH, (1968).

73824   HY-150 K_{Iscc}

Smith, J. H., and Rolfe, S. T., "Effect of Composition on the K_{Iscc} of Experimental HY-150 Steels", Technical Report No. 39.018-016(10), United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Contract NObs-94535 (FBM) (December 20, 1968

73829   18Ni (250)MAR K_{Iscc}

Novak, S. R., and Rolfe, S. T., "Comparison of Fracture-Mechanics and Normal-Stress Analyses in Stress-Corrosion Testing", Report No. 89.018-026(3), United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Contract NObs-94535 (FBM) (December 20, 1968).

73988   300M K_c

Pendelberry, S. L., Simenz, R. F., and Walker, E. K., "Fracture Toughness and Crack Propagation of 300 M Steel", FAA Technical Report No. DS-68-18 (August 1968).

74232   HP 9-4-.20 K_{Iscc}
          12Ni-5Cr-3Mo K_{Iscc}
          18Ni (250)MAR K_{Iscc}

Sinclair, G. M., and Rolfe, S. T., "Analytical Procedure for Relating Subcritical Crack Growth to Inspection Requirements", University of Illinois, Urbana, Ill., and United States Steel Corporation, Applied Research Laboratory, Monroeville, PA, Paper presented at the Metals Engineering Conference of ASME, Washington, D.C., on March 31 to April 2, 1969.

74302   HP 9-4-.30 K_{Iscc}
          300M K_{Iscc}

Carter, C. S., "Crack Extension in Several High-Strength Steels Loaded in 3.5% Sodium Chloride Solution", Research Report D6-19770, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (November 1967).

74718   300M K_{Iscc}
          4340 K_{Iscc}, da/dt
          4340(MOD) K_{Iscc}

Carter, C. S., "The Effect of Silicon on the Stress Corrosion Resistance of Low-Alloy, High-Strength Steels", Research Report D6-23872, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (March 1965).

74719   18Ni (200)MAR   da/dt
          18Ni (350)MAR   da/dt

Carter, C. S., "Stress Corrosion Crack Branching in High-Strength Steels", Research Report D6-23781, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (March 1965).

TABLE 6.36   (Cont)

75025   4340 K_{Iscc}

Procter, R. P. M., and Paxton, H. W., "The Effect of Prior Austenite Grain Size on the Stress Corrosion Cracking Susceptibility of A.I.S.I. 4340 Steel", Research Project, Carnegie-Mellon University, Pittsburgh, PA (January 1969).

75111   H11   da/dt

Wei, R. P., and Landes, J. D., "Correlation Between Sustained-Load and Fatigue Crack Growth on High-Strength Steels", Materials Research and Standards, $\underline{9}$ (7), 25-28 (July 1969).

75677   18Ni (350) MAR K_{Iscc}

Carter, C. S., "The Effect of Heat Treatment on the Fracture Toughness and Subcritical Crack Growth Characteristics of a 350-Grade Maraging Steel", Report D6-22978, The Boeing Company, Renton, Wash., Contract N00014-66-C0365 (June 1969).

76411   HP 9-4-.25 (VAR) K_{Ic}
         18Ni (200) MAR K_{Ic}

Wessel, E. T., et al., "Engineering Methods for the Design and Selection of Materials Against Fracture", Final Technical Report, Westinghouse Research Laboratories, Pittsburgh, PA, Contract DA-30-069-AMC-602 (T) (June 24, 1966).

76972   4340 K_{Iscc}
         4340V   da/dt

Colangelo, V. J., and Ferguson, M. S., "The Role of the Strain Hardening Exponent in Stress Corrosion Cracking of a High Strength Steel", Corrosion, $\underline{25}$ (12) 509-514 (December 1969).

77716   18Ni(300)MAR K_{Iscc}

Stavros, A. J., and Paxton, H. W., "Stress-Corrosion Cracking Behavior of an 18% Ni Maraging Steel", Homer Research Laboratories, Bethlehem Steel Corporation, Bethlehem, PA, and Carnegie-Mellon University, Pittsburgh, PA, ARPA Contract Nonr-760(31) (April 1970).

78065   18Ni (250)MAR K_{Iscc}

Novak, S. R., and Rolfe, S. T., "Comparison of Fracture Mechanics and Nominal Stress Analysis in Stress Corrosion Cracking", Corrosion, $\underline{26}$(4) 121-130(April 1970).

78305   300M K_{Ic} K_{Iscc}
         300M(VM) K_{Ic}

Webster, D., "Effect of Grain Refinement on the Microstructure and Mechanical Properties of 4340M", Summary Report D6-25220, The Boeing Company, Seattle, Wash., ARPA Contract N00014-66-C-0365 (April 1970).

78313   18Ni (250)MAR   da/dt
         300M   da/dt

Hyatt, M. V., "Use of Precracked Specimens in Stress-Corrosion Testing of High-Strength Aluminum Alloys", Summary Report D6-24466, The Boeing Company, Renton, Wash., ARPA Contract N00014-66-C-0365 (November 1969).

TABLE 6.36 (Cont)

78425   18Ni (300) MAR K_{Iscc}, da/dN

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78761   18Ni (300) MAR K_{Iscc}
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80423   4340 K_{Iscc}
        4340 (MOD) K_{Iscc}

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        18Ni (200) MAR K_{Iscc}

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81004   18Ni (180) MAR K_{Iscc}
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81814   4340 K_{Iscc}, da/dt

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82164   18Ni (280) MAR K_{Iscc}

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83611   4340 (EFM) da/dt

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        12Ni-5Cr-3Mo K_{Iscc}
        18Ni (180)MAR K_{Iscc}
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83834   18Ni (200) MAR K_{Ic}
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84029   D6AC K_{Ic}
        HP 9-4-.30 K_{Ic}
        300M K_{Ic}
        4330V (MOD) K_{Ic}
        4340 K_{Ic}

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84277   D6AC K_{Ic}
        4330V (MOD) K_{Ic}
        4340 K_{Ic}

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84278   300M (VM) K_{Ic}

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84280   300M K_{Ic}
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84309   H11   da/dt
          4340 da/dt

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          4340   da/dt

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84313   4340   da/dt

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84351   HP 9-4-.45 K_{Iscc}
          H11 K_{Iscc}
          18Ni (250) MAR K_{Iscc}
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          4330V K_{Iscc}

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84356   18Ni (300) MAR K_{Iscc}
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85836   HP 9-4-.20 K_{Ic}
        300M K_{Ic}

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85837   HP 9-4-.20 da/dN
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85883   D6AC K_{Ic}
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86582   4340 K_{Ic}

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37241   300M K_{Ic}
        4140 K_{Ic}
        4330V (MOD) K_{Ic}
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88140   HP 9-4-.30 da/dN

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88575   10Ni   da/dN

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88579   HP 9-4-.20 da/dN
        HP 9-4-.30 da/dN

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89311   4340 da/dN

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90012   HP 9-4-.20 K_{Ic}

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AM002   HP 9-4-.30 K_{Ic}

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         HY-180   da/dN
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MA005   HP 9-4-.20 K_{Ic}, K_{Iscc}, da/dN
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          300M   da/dN

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MA010   HP 9-4-.30 da/dN
          300M   da/dN

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MA011   4330V (MOD) K_{Ic}, da/dN

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MA012   4340 da/dN

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MD001   D6AC K_{Ic}

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MR002   4140 K_{Ic}
          4340 K_{Ic}

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NC002   HP 9-4-.20 (CEVM)   da/dN

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